Appendix 5.7

Greenhouse Gas Emissions Appendices

Appendix 5.7A

Greenhouse Gas Emissions Technical Report

ENVIRON International Corporation

February 2015

Greenhouse Gas Emissions Technical Report

Entrada South

Los Angeles County, California

Prepared for:
The Newhall Land and Farming Company
Valencia, California

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Date:
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ENVIRON

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Acronyms and Abbreviations

°C	Celsius
°F	Fahrenheit
AB	Assembly Bill
ACC	Advanced Clean Car
ACR	American Carbon Registry
AR	Assessment Report
BAU	Business-As-Usual
CAA	Clean Air Act
CalEEMod®	California Emission Estimator Model®
CalGreen	CalGreen Building Standards
CalRecycle	California Department of Resources Recycling and Recovery
CAPCOA	California Air Pollution Control Officers Association
CAR	Climate Action Reserve
CARB	California Air Resources Board
CCAP	Community Climate Action Plan
CCAR	California Climate Action Registry
CCCC	California Climate Change Center
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CEUS	Commercial End-Use Survey
CFC	Chlorofluorocarbon
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	CO_2 Equivalents
CPUC	California Public Utilities Commission
CTR	Commute Trip Reduction
DOE	Department of Energy
DOT	Department of Transportation
DWR	Department of Water Resources

EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act of 2007
EMFAC	EMission FACtor Model
ENVIRON	ENVIRON International Corporation
ES	Executive Summary
GHG	Greenhouse Gas
GHG R_X	Greenhouse Gas Reduction Exchange
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
LCFS	Low Carbon Fuel Standard
MMRP	Mitigation Monitoring and Reporting Program
MPO	Metropolitan Planning Organization
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NAT	No Action Taken
NHTSA	National Highway Traffic Safety Administration
NRSP	Newhall Ranch Specific Plan
OFFROAD	Emissions Inventory Program model
OVOV	One Valley One Vision
PDF	Project Design Features
PUP	Power/Utility Protocol
PV	Photovoltaic
RASS	Residential Appliance Saturation Survey
RCP	Representative Concentration Pathways
RFS	Renewable Fuel Standard
RMDP	Resource Management and Development Plan
RPS	Renewable Portfolio Standards
RTP	Regional Transportation Plan
SB	Senate Bill
SCAB	South Coast Air Basin

SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCP	Spineflower Conservation Plan
SCS	Sustainable Communities Strategies
SCVCTM	Santa Clarita Valley Consolidated Traffic Model
SFH	Single Family Home
SRES	Special Report on Emissions Scenarios
SWP	State Water Project
TAZ	Traffic Analysis Zones
TDM	Transportation Demand Management
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
VTTM	Vesting Tentative Tract Map
ZNE	Zero Net Energy

Units of Measurements

BTU	British Thermal Units
kW	Kilowatt
lb	Pound
m	Meter
Mgal/year	Thousand Gallons per Year
mpg	Miles per Gallon
MT	Metric Tonnes
$MTCO_2e$	Metric Tonnes of CO_2 Equivalent
MT/year	Metric Tonnes per Year
MW	Megawatt
MWh	Megawatt-Hour
ppm	Parts per Million
sfqt	Square Feet
yr	Year

Executive Summary

The Entrada South Project includes 339 single-family units, 1,235 multi-family units, and 730,000 square feet (sqft) of commercial uses anticipated to be comprised of approximately 435,000 sqft of office uses and approximately 295,000 sqft of commercial retail uses. In addition, the Project includes a 9.4-acre elementary school, a 5.6-acre public neighborhood park, 101.7 acres of open space areas, two private recreational centers within 2.9 acres, and a 27.2-acre preserve for spineflower.[1] Facilities and infrastructure proposed as part of the Project consist of a network of roads and trails, drainage and water quality improvements, dry utilities systems, a potable water system, a recycled water system, and a sanitary sewer system. The construction of Entrada South is assumed to occur between 2015 and 2024. This Executive Summary includes a short description of the analysis scope and methodology and the results of the analysis to assess greenhouse gas (GHG) emissions due to the Project.

The GHG emissions inventory for this analysis includes the following sources of annual direct and indirect emissions: (1) area sources (e.g., landscaping-related fuel combustion sources and natural gas fireplaces); (2) energy use associated with residential and non-residential buildings; (3) water and wastewater; (4) solid waste; (5) mobile sources (e.g., passenger vehicles); (6) construction; and (7) vegetation changes. The ongoing operational emissions consist of the first five categories, while the one-time emissions are associated with construction and vegetation changes. The typical types of GHG emissions resulting from mixed-use developments such as the Project are emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG emissions are typically measured in terms of tonnes of CO_2 equivalents (CO_2e), calculated as the product of the mass emitted of a given GHG and its specific global warming potential (GWP).

This analysis primarily utilized the California Emission Estimator Model version 2013.2.2 (CalEEMod®)[2] to assist in quantifying the GHG emissions in the inventories presented in this report for the Project. CalEEMod® is a statewide program designed to calculate both criteria and GHG emissions from development projects in California. Third-party studies were also relied upon to support analyses and assumptions made outside of CalEEMod®.

At this time, there are no applicable, adopted numeric thresholds that govern the determination of the significance of the Project's GHG emissions under the California Environmental Quality Act (CEQA). However, the State CEQA Guidelines provide useful information regarding the assessment of the Project's GHG emissions. This GHG Emissions Technical Report assesses the significance of the Project's GHG emissions, using five different methodologies. Further, each of the five methodologies is a separate and independent basis for the significance determination herein.

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[1] The entire Project site encompasses approximately 382 acres of VTTM area, and approximately 119 acres of External Map area.

[2] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/.Accessed: May 2014.

First, and in accordance with State CEQA Guidelines sections 15064.4(b)(1) and 15125(a), this report considers the "extent to which the [P]roject may increase or reduce [GHG] emissions as compared to the existing environmental setting." As documented in subsequent portions of this report and shown in **Table ES-1**, the Project site – in its existing condition – emits approximately 13.2 metric tonnes (MT) of CO_2e per year, whereas the Project emits approximately 49,012 MT CO_2e per year (as shown in **Table ES-2**). While the Project results in a change to the existing environment, by increasing existing GHG emission levels by approximately 48,999 MT of CO_2e per year, there is no scientific or regulatory consensus regarding what particular quantity of GHG emissions is significant. Therefore, this numeric change is not a meaningful, informative or reliable indicator of the Project's significance. For additional comparison, the Project percentage contribution to the existing international, national, and state GHG emission inventories are 0.0001%, 0.0008%, and 0.01% respectively, as presented in **Table ES-2**.

The second and third methodologies are utilized in this report to assess the Project's significance under AB 32. These methodologies consider (i) whether the Project's emissions "exceed a threshold of significance that the lead agency determines applies" and (ii) "the extent to which the [P]roject complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of [GHG] emissions" in accordance with State CEQA Guidelines section 15064.4(b)(2)-(3). In assessing the Project's significance under these two criteria, reference is made to the California Global Warming Solutions Act of 2006, also known as Assembly Bill 32 (AB 32). AB 32 requires the State to achieve 1990 levels of GHG emissions by 2020, which numerically equates to a 28.5 percent reduction in GHG emissions per the AB 32 Scoping Plan.

For the second methodology, the report compares the proposed Project's emissions to the Project's emissions if the Project were built using a Business-As-Usual (BAU) or No Action Taken (NAT) approach in terms of design, methodology, and technology. If the proposed Project results in 29 percent (conservatively rounded from 28.5 percent) fewer GHG emissions than the BAU Project (i.e., California Air Resources Board [CARB] 2020 NAT scenario), impacts are less than significant. This methodology is based on the CARB's Scoping Plan, which was adopted pursuant to AB 32 and found that statewide GHG emission levels need to be reduced by 28.5 percent in order for the State to achieve the mandate of AB 32. As shown in **Table ES-3**, the emissions for the Project and its associated NAT scenario are estimated to be approximately 49,012 and 71,901 MT CO_2e per year, respectively, which results in a Project emission reduction of 31.8 percent from the NAT scenario. As such, the Project will not result in significant impacts under this methodology.

The Project will incorporate certain design elements and project design features, including limiting fireplaces, installing solar panels or purchasing equivalent carbon offsets/credits, installing a solar-heated swimming pool at the community recreational center, and traffic-related emission reduction strategies. In addition, the project will benefit from and comply with various statewide initiatives including the 33% Renewable Portfolio Standard (RPS), 2013 Title 24 standards, Pavley regulation, Low Carbon Fuel Standard (LCFS), Advanced Clean Car program, the 20% indoor water consumption reduction required by CalGreen, and statewide recycled-water policy. The design elements and project design features will reduce the Project GHG emissions by 4,629 MT/year, or 6.4% of the CARB 2020 NAT emissions, as shown in

Table ES-4. The compliance with regulatory measures will further reduce the Project GHG emissions by 18,383 MT/year, or 25.6% of the CARB 2020 NAT emissions (The emission reduction of 124 MT/year associated with telecommuting was taken out from PDF-4 through PDF-7 in **Table ES-4** because both CARB 2020 NAT and the 2020 Project scenarios assumed telecommuting.). Together, the design elements/project design features (minus the telecommuting) and statewide initiatives will reduce the Project GHG emissions by 22,888 MT/year, or 31.8% of the CARB 2020 NAT emissions. A comparison of ES-3 and ES-4 indicates that: (1) the emission reduction between the 2020 Project and the 2020 Project without PDFs is attributable to the implementation of the design elements and project design features, and (2) the emission reduction between the 2020 Project and the CARB 2020 NAT is attributable to both the implementation of the design elements and project design features, and statewide initiatives.

For the third methodology, the report compares the Project's emissions to the South Coast Air Quality Management District's (SCAQMD or District) draft efficiency target for 2020. The District's draft 2020 target for project-level analysis is 4.8 MT/year CO_2e per service population (service population is defined as residents and land use employment). When assessing the Project's GHG emissions with this methodology, the report utilized a modified emissions inventory to compare against the efficiency target because the District's draft definition of "service population" leads to a negative bias for projects with high numbers of "customers" or "visitors", such as retail, hospitals and medical offices. With the District's draft approach, the emissions from customers and visitors are included in the total emissions, but these customers and visitors are excluded from the service population. The modified emissions inventory used in this report evaluates the emissions associated with the defined service population; as such, mobile source emissions associated with customers and visitors are excluded from the emissions total. As shown in **Table ES-5**, the Project's efficiency metric is estimated to be 4.67 MT/year CO_2e per service population, such that the Project will not result in significant impacts under this methodology, as well.The fourth methodology assesses the Project's significance under the Sustainable Communities and Climate Protection Act of 2008, also known as Senate Bill 375 (SB 375). SB 375 requires the State's metropolitan planning organizations to adopt Sustainable Communities Strategies (SCS) that coordinate transportation and land use planning in order to reduce GHG emissions from light duty, passenger vehicles. The SB 375 analysis specifically evaluates the consistency of the Project's land use assumptions with the Southern California Association of Governments' (SCAG) 2012 SCS was evaluated by reference to the number of households in SCAG's traffic analysis zones (TAZs). Based on that evaluation, the Project is consistent with SCAG's SCS and will not impair the region's ability to achieve the GHG reductions from light duty vehicles required by SB 375 because the land use development pattern proposed by the Project is in line with SCAG's SCS growth patterns (see Appendix F).

In addition, the fifth methodology assesses the Project's consistency with Executive Order S-3-05's long-term goal to reduce GHG emissions to 80 percent below 1990 levels by 2050. While it would be speculative to quantitatively estimate the Project's emissions level in 2050, the evolving regulatory framework suggests that the Project's emissions inventory will decrease with time, consistent with the Executive Order's objective to secure further reductions in California's

GHG emissions level. In particular, in order to reach the 2050 goal, activities, such as decarbonization of the fuel supply, will need to occur.[3] Reducing the carbon content of motor fuels and fuels for electricity generation will reduce CO_2e emissions from this Project. Therefore, it is reasonable to expect the Project's emissions level (approximately 49,012 metric tonnes of CO_2e per year) to decline as the regulatory initiatives identified by CARB in the First Update are implemented, and other technological innovations occur. Stated differently, the Project's emissions total at build-out represents the maximum emissions inventory for the Project as California's emissions sources are being regulated (and foreseeably expected to continue to be regulated in the future) in furtherance of the State's environmental policy objectives. Given the reasonably anticipated decline in Project emissions once fully constructed and operational, the Project is consistent with the Executive Order's 2050 target.

[3] California Energy Commission. 2007. State Alternative Fuels Plan. December. CEC-600-2007-011-CMF. Available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF. Accessed: January 2015.

Table ES-1. Summary of Baseline/Existing Condition GHG Emissions
Entrada South
Los Angeles County, California

Category	CO_2e Emissions (MT/year)
Energy use associated with water	11.2
N_2O emissions associated with fertilizer use	1.4
Diesel fuel usage	0.5
Total	**13.2**

Abbreviations:
CO_2e - carbon dioxide equivalent
GHG - greenhouse gas
MT - metric tonne
N_2O - nitrous oxide

Table ES-2. Project GHG Emissions Percentage Contribution to Existing International, National, and State Inventories
Entrada South
Los Angeles County, California

Emission Inventory	CO_2e Emissions[1]	CO_2e Percentage Contribution to Existing Inventory
	MT/yr	MT/yr
Project	49,012	--
State of California - 2012[2]	459,000,000	0.01%
United States of America - 2012[3]	6,525,600,000	0.0008%
Global - 2010[4]	50,101,410,000	0.0001%

Notes:

[1] CO_2e includes CO_2, CH_4, N_2O emissions. For all emission inventories other than "Project", halogenated compounds, which are associated with industrial activity and not expected to be a component of Project emissions, are included . All species are weighted by their respective global warming potentials to calculate CO_2e.

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tons
N_2O - nitrous oxide
USEPA - United States Environmental Protection Agency
yr - year

References:

[2] CARB. 2014. California Greenhouse Gas Inventory: 2000-2012. Available at: http://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-12_report.pdf. Accessed: May 2014.

[3] USEPA. 2014. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. Available at: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Main-Text.pdf. Accessed: May 2014.

[4] Joint Research Centre, European Commission. 2013. GHG (CO2, CH4, N2O, F gases) emission time series 1990-2010 per region/country. Emission Database for Global Atmospheric Research. Available at: http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts1990-2010. Accessed: May 2014.

Table ES-3. Summary of Project GHG Emissions in Comparison to CARB 2020 NAT
Entrada South
Los Angeles County, California

Category[1]	CO_2e Emissions[2]			
	CARB 2020 NAT (MT/yr)	2020 Project without PDFs (MT/yr)	2020 Project (MT/yr)	% Reduction of 2020 Project from CARB 2020 NAT
Area	369	369	331	-10.29%
Energy Use	8,755	6,448	5,713	-34.75%
Water Use	1,620	1,167	1,167	-27.94%
Waste Disposed	3,600	1,800	1,800	-50.00%
Traffic (with breakdown shown below)	57,196	43,497	39,641	-30.69%
Elementary School	1,157	878	800	--
Public Neighborhood Park	21	16	15	--
Single Family Housing	4,983	3,791	3,454	--
2-Story and 2&3 Story Condos	10,345	7,871	7,170	--
3-Story and 4-Story Condos	7,907	6,016	5,480	--
Commercial (Modeled as Regional Shopping Center)	24,445	18,586	16,941	--
Commercial (Modeled as Strip Mall)	1,955	1,486	1,355	--
Office	6,373	4,845	4,420	--
Recreational Center	10	8	7	--
Parking Structure	0	0	0	--
Parking	0	0	0	--
Sub-Total	**71,541**	**53,282**	**48,652**	-31.99%
Construction Amortized[3]	317	317	317	0.00%
Vegetation Amortized[3]	43	43	43	0.00%
Sub-Total	**360**	**360**	**360**	0.00%
Total	**71,901**	**53,642**	**49,012**	-31.83%

Notes:

[1] CO_2e emissions were estimated using CalEEMod® version 2013.2.2 for all operational categories, with the exception of energy required for heating and maintaining the recreational swimming pool.

[2] CO_2e includes CO_2, CH_4, and N_2O emissions, which are weighted by their respective global warming potentials.

[3] One-time emissions from construction and vegetation removal were amortized over a 30-year period. Source: SCAQMD. 2009. Minutes for the GHG CEQA Significance Threshold Stakeholder Working Group #13. August. Available online at: http://sfprod.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-13/ghg-meeting-13-minutes.pdf?sfvrsn=2. Accessed: May 2014.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CEQA - California Environmental Air Quality Act
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tons
NAT - No Action Taken
N_2O - nitrous oxide
PDF - project design feature
SCAQMD - South Coast Air Quality Management District
yr - year

Table ES-4. Summary of GHG Emission Reductions due to Design Elements/Project Design Features and Other Technological and Statewide Initiatives

Entrada South

Los Angeles County, California

Emission Reductions due to Design Elements/Project Design Features		
PDF Number[1]	**PDF Description**	**CO_2e Emissions Reduction due to PDF and Other Attributes[2,3]**
		MT/yr
PDF-1	Reducing Number of Dwelling Units with Fireplaces from 90% to 80%	38
PDF-2	Installing Solar Panels on Residential and Commercial Rooftops or Purchasing Equivalent Carbon Offsets/Credits	436
PDF-3	Using Solar Heating for Pool at Recreational Center	299
PDF-4 through PDF-7 and other attributes[4]	Collection of Transportation Demand Management (TDM) measures including Transit Network Expansion, Pedestrian Network Improvements, Traffic Calming, Implementation of Voluntary Commute Trip Reduction Program, Implementation of Ride-Sharing Programs, Encouraging Telecommuting and Alternative Work Schedules, and Traffic Flow Improvement	3,856
	Total Emission Reductions from PDFs	**4,629**
Emission Reductions due to Other Initiatives		
Other Initiatives and Emission Category Affected	**Initiative Description**	**CO_2e Emissions Reduction Due to Initiative**
		MT/yr
33% RPS - Energy Emissions	Carbon Dioxide Equivalent (CO_2e) Intensity Factor with a 33% Renewables Portfolio Standard (RPS)	**1,193**
33% RPS - Water Emissions[5]		**259**
2013 Title 24 Standard - Energy Emissions	2013 Building Energy Efficiency Standards (Title 24, Part 6)	**1,115**
Pavley - Mobile Emissions[6]	Higher Fuel Efficiency Regulatory Standard for Cars and Light-Duty Vehicles	**8,049**
LCFS - Mobile Emissions[6]	Low Carbon Fuel Standard	**4,924**
ACC - Mobile Emissions[6]	Advanced Clean Cars program	**850**
20% Reduction in Indoor Water Use from CalGreen Building Standards - Water Emissions[5]	20 Percent Reduction for Indoor Water Consumption per CalGreen Building Standards (Title 24, Part 11)	**154**
75% Solid Waste Diversion - Waste Emissions	75 Percent Solid Waste Diversion via Reduction, Recycling or Composting by 2020	**1,800**
Recycled Water	Increased Recycled Water Usage by 0.2 million Acre-Feet per Year by 2020	**39**
	Total Emission Reductions from Statewide Initiatives	**18,383**
	Emission Reduction due to Telecommuting[7]	**-124**
	Combined Emission Reductions from CARB 2020 NAT Scenario	**22,888**

Notes:

[1] These PDF numbers are defined in Section 1.1 Project Description.

[2] CO_2e emissions were estimated using CalEEMod® version 2013.2.2 for all operational categories, with the exception of energy required for heating and maintaining the recreational swimming pool.

[3] CO_2e includes CO_2, CH_4, and N_2O emissions, weighted by their respective global warming potentials.

[4] The PDFs and other attributes accounted for in this table row are those design elements and project design features corresponding to the following CAPCOA transportation-related GHG reduction strategies: TST-3; SDT-1; SDT-2; TRT-1; TRT-3; TRT-6; and, RPT-2, as described in Section 3.3.5 and Appendix D of the report.

[5] The reduction in emissions from water supply, conveyance and treatment, and wastewater treatment would occur due to two statewide initiatives - (1) 33% RPS; and (2) 20% reduction in indoor water usage. The Project emissions calculations assume both measures would result in a total emissions reduction of 414 MT CO_2e/yr. The emission reduction due to RPS is based on the water demand incorporating the 20% indoor water reduction. The emission reduction attributed to the 20% indoor water reduction was estimated as the remaining difference (i.e., 414 minus 259 equals 154, and the one MT CO2e difference is due to rounding).

[6] The reduction in mobile emissions would occur due to three statewide initiatives - (1) Pavley, (2) LCFS and (3) ACC. The project emission calculations assume all three measures would go into effect, which would result in a total emissions reduction of 13,822 MT CO_2e/yr. The emission reduction associated with Pavley varies by vehicle category (ranging from 12% to 23% for light- and medium-duty vehicles compared to without Pavley). The LCFS emission reduction is estimated as 10% across all vehicle categories compared to without LCFS. The emission reduction due to ACC was estimated by evaluating two separate analysis of with and without ACC reductions. Similarly, the emission reduction due to LCFS was estimated by comparing two separate analyses with and without LCFS. The remaining emission reduction was attributed to Pavley (i.e., 13,822 minus 850 minus 4,924 equals 8,049).

[7] The negative value shown "removes" the additional reduction of 0.3% to mobile vehicle mile travelled because the telecommuting emission reduction is also included in the CARB 2020 NAT scenario. While the emission reduction from telecommuting is considered part of a Project Design Feature (PDF-4 and -5), it is conservatively included as part of the CARB 2020 NAT scenario. Thus, the emission reduction due to telecommuting does not contribute to the difference in emissions when comparing the CARB 2020 NAT scenario and the Project.

Abbreviations:

ACC - Advanced Clean Car
CalEEMod® - CALifornia Emissions Estimator MODel
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
LCFS - Low Carbon Fuel Standard
MT - metric tons
N_2O - nitrous oxide
PDF - project design feature
RPS - Renewables Portfolio Standard
TDM - transportation demand management
yr - year

Table ES-5. Summary of Project GHG Emissions in Comparison to an Efficiency Metric
Entrada South
Los Angeles County, California

Category[1]	CO_2e Emissions[2] 2020 Project without Customer Trips (MT/yr)[3]
Area	**331**
Energy Use	**5,713**
Water Use	**1,167**
Waste Disposed	**1,800**
Traffic (with breakdown shown below)	**27,807**
Elementary School	800
Public Neighborhood Park	15
Single Family Housing	3,454
2-Story and 2&3 Story Condos	7,170
3-Story and 4-Story Condos	5,480
Commercial (Modeled as Regional Shopping Center)[3]	5,980
Commercial (Modeled as Strip Mall)[3]	482
Office	4,420
Recreational Center	7
Parking Structure	0
Parking	0
Sub-Total	**36,819**
Construction Amortized[4]	317
Vegetation Amortized[4]	43
Sub-Total	**360**
Total	**37,179**
Service Population	7,967
Emissions per Service Population with Amortized Emissions (MT/SP-yr)[5]	4.67
SCAQMD Efficiency Metric Threshold	4.8
Above Threshold?	No

Notes:

[1] CO_2e emissions were estimated using CalEEMod® version 2013.2.2 for all operational categories, with the exception of energy required for heating and maintaining the recreational swimming pool.

[2] CO_2e includes CO_2, CH_4, and N_2O emissions, which are weighted by their respective global warming potentials.

[3] Emissions for the Regional Shopping Center and Strip Mall land use categories were adjusted to remove the contribution of customer trips consistent with the defined service population, which excludes customers and visitors. Based on CalEEMod® defaults, customer trips for Regional Shopping Center and Strip Mall are 64.7% and 64.4%, respectively. The traffic-related emissions for these land uses still include those associated with the workers at these land uses, as the workers are included in the defined service population. Although students are not included in the service population, student-related school trips are conservatively included in the emissions.

[4] One-time emissions from construction and vegetation removal were amortized over a 30-year period. Source: SCAQMD. 2009. Minutes for the GHG CEQA Significance Threshold Stakeholder Working Group #13. August. Available online at: http://sfprod.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-13/ghg-meeting-13-minutes.pdf?sfvrsn=2. Accessed: May 2014.

[5] Service Population includes residents (5,288), commercial workers (2,597), and school employees (82). Residents were estimated using the average number of persons per household from 2010 United States Census data and number of dwelling units of the Project. Commercial worker population was based on the CBRE job creation memorandum, and school worker population and city park workers were based on a jobs per 1,000 square footage factor from the One Vision One Valley Environmental Impact Report.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CEQA - California Environmental Quality Act
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tons
N_2O - nitrous oxide
SCAQMD - South Coast Air Quality Management District
SP - service population
yr - year

1 Introduction

The purpose of this technical report is to present the quantitative analyses that were used to evaluate the Project's greenhouse gas (GHG) emissions. Emissions during both construction and operation of the Project were quantified. Legislation and rules regarding climate change, as well as the scientific understanding of the extent to which different activities emit GHGs, continue to evolve; as such, the inventory in this report is a reflection of the guidance and knowledge currently available.

1.1 Project Description

The Entrada South Project, located on a 501.4-acre site, includes 339 single-family units, 1,235 multi-family units, and 730,000 square feet (sqft) of commercial uses anticipated to be comprised of approximately 435,000 sqft of office uses and approximately 295,000 sqft of commercial retail uses. In addition, the Project includes a 9.4-acre elementary school, a 5.6-acre public neighborhood park, 101.7 acres of open space areas, two private recreational centers within 2.9 acres, and a 27.2-acre preserve for spineflower.[4] Facilities and infrastructure proposed as part of the Project consist of a network of roads and trails, drainage and water quality improvements, dry utilities systems, a potable water system, a recycled water system, and a sanitary sewer system. The construction of Entrada South is assumed to occur between 2015 and 2024. **Table 1** summarizes the land uses for the Project.

Analysis of the Project's GHG emissions incorporates the following statewide initiatives, design elements, and project design features (PDFs):

1.1.1 Statewide Initiatives – Quantified Reductions

- The carbon dioxide equivalent (CO_2e) intensity factor for the Project will include the 33% RPS;
- The Pavley regulation mandating higher fuel efficiency standards for cars and light-duty vehicles, LCFS, and the Advanced Clean Cars program are included in the vehicle emissions estimate for the Project;
- The Project will meet the statewide 2013 Building Energy Efficiency Standards, formally known as Title 24, Part 6;
- The Project will meet the statewide goal of 75% solid waste diversion by 2020, by reducing, recycling, or composting the generated waste; and
- The Project will meet the statewide goal of 20% reduction for indoor water consumption by 2020 as required by CalGreen Building Standards (CalGreen), formally known as Title 24, Part 11, through the use of water saving fixtures and/or flow restrictors.

[4] Open space acreage refers to lots within the tract map designated as open space. Additional open space areas, such as natural drainage courses, roadway medians, and landscaped parkways adjacent to on-site roadways, in addition to the proposed park, recreation centers, and Spineflower Preserve, bring the total open space area to approximately 153 acres.

- The Project will contribute to achieving the statewide goal of increased recycled water usage by 0.2 million acre-feet per year by 2020, as mandated by the State Water Resources Control Board.[5]

1.1.2 Design Elements

Transit System Improvements, Expand Transit Network: As discussed in Section 3.0 of this Draft Environmental Impact Report (EIR), Santa Clarita Transit service would be expanded to service the Project Site. Specifically, existing routes would be expanded or new routes added to provide transit access from the Project Site to the Valencia Commerce Center area, Valencia Industrial Center area and Newhall Metrolink Station, resulting in a net increase in transit service of approximately 21.8 miles.

Neighborhood/Site Design, Provide Pedestrian Network Improvements: As shown in **Figure 3-13**, Project Trails Plan, in Section 3.0, Project Description, of this Draft EIR, the Project includes an extensive community trail system throughout the Project Site, which would be linked to the Newhall Ranch Specific Plan (NRSP) trail system to the west and the existing community of Westridge to the south. As illustrated, the proposed trail system would include community trails, bike lanes, paseos, and recreational trails. Overall, the Project would include approximately 33,150 linear feet of trails and paseos with direct connections between the proposed residential uses, commercial uses, the elementary school site, recreational centers, and park uses. In addition, approximately 8,090 linear feet of Class II bike lanes would be provided.

Neighborhood/Site Design, Traffic Calming Measures: As discussed above, the Project includes community trails, bike lanes, paseos, and recreational trails that would not only provide the actual infrastructure to facilitate non-vehicular travel, but would also provide a more attractive walking environment through the reduction and slowing of roadway traffic volumes (e.g., marked crosswalks, count-down signal timers, curb extensions, median islands, on-street parking, planter strips with street trees, and chokers). For example:

- The community trails would be paved pedestrian/bicycle routes in landscaped parkways and located adjacent to major roads in order to connect the existing and proposed communities in the area;
- Paseos would be paved pedestrian/bicycle routes and would provide pedestrian access between residential neighborhoods and the neighborhood park, the private recreation centers, the elementary school, the community and local trails, and the larger commercial area; and,
- Recreational trails would provide pedestrian/bicycle access and may or may not be paved.

The approximate combined length of these trails is 13,740 linear feet.

[5] The California Water Resources Control Board adopted the recycled water policy in 2009 and revised the policy in 2013. Available at: http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf. Accessed: January 2015.

1.1.3 Project Design Features – Quantified Reductions

PDF-1: No more than 80 percent of all residential units shall contain natural gas-fired fireplaces;

PDF-2: The Project shall produce or cause to be produced renewable electricity, or secure GHG offsets or **credits** from a public agency (e.g., California Air Resources Board [CARB], South Coast Air Quality Management District [SCAQMD]) endorsed market, equivalent to the installation of one photovoltaic (PV) (i.e., solar) power system no smaller than 2-kilowatt (kW) solar panel for every single-family residence, and for every 1,600 square feet of non-residential roof area. (This PDF is consistent with and implements MM RMDP/SCP GCC-3, and GCC-4.);

PDF-3: The Project will use solar water heaters to provide 100 percent of the heating needs for the public pool at the community recreational center. (This PDF is consistent with and implements MM RMDP/SCP GCC-6.);

PDF-4: The Project Applicant or its designee shall prepare a voluntary Commute Trip Reduction (CTR) program to discourage single-occupancy vehicle trips and encourage alternative modes of transportation, such as carpooling, taking transit, walking, and biking. The voluntary CTR program will then be utilized by employers to provide employees with assistance in using alternative modes of travel, and provide both “carrots” and “sticks” to encourage employees. The voluntary CTR program should include all of the following to secure the effectiveness reported by California Air Pollution Control Officers Association (CAPCOA) guidance:

- Carpooling encouragement
- Ride-matching assistance
- Preferential carpool parking
- Flexible work schedules for carpools
- Half time transportation coordinator
- Vanpool assistance

Bicycle end-trip facilities (parking, showers and lockers)

PDF-5: Commercial builders/property owners shall promote ride-sharing through a multi-faceted approach that includes, but is not limited to, the measures below:

- Designating a certain percentage of parking spaces for ride-sharing vehicles that is equivalent to at least one dedicated parking space per 25,000 sqft of office space (verified by County of Los Angeles prior to issuance of building permit(s));
- Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles (verified by County of Los Angeles prior to issuance of building permit(s)); and

Providing a web site or message board for coordinating rides (implemented during operational phase by property owners).

PDF-6: The Project Applicant or its designee shall require employers with 100 or more employees within the Project Site to develop and implement a telecommuting program consisting of the following elements: (1) appointment of a telecommuting coordinator; (2)

identification of specific categories of employment positions that are appropriate for telecommuting; (3) provision of required equipment (e.g., hardware, software, and security); and (4) establishment of communications strategies to facilitate satisfaction of employment responsibilities (e.g., instant messaging); and

PDF-7: The Project Applicant or its designee shall work with the applicable agency(ies) with jurisdiction over the local roadway network to facilitate traffic signal coordination along Magic Mountain Parkway from Commerce Center Drive to The Old Road and along The Old Road from Skyview Lane to the signalized Shopping Center Driveway just south of Magic Mountain Parkway).

In addition, the following PDF has been incorporated into the Project's design, but not quantitatively factored into the analysis presented herein because of the inherent uncertainty regarding what percentage of home buyers will elect to install solar energy systems on their single-family residences. This PDF will be included, however, in the Mitigation Monitoring and Reporting Program (MMRP) to ensure implementation:

PDF-8: Consistent with the Governor's Million Solar Roofs Plan, the Project Applicant or its designee, acting as the seller of any single-family residence constructed as part of the development of at least 50 homes that are intended or offered for sale, shall offer a solar energy system option to all customers who enter negotiations to purchase a new production home constructed on land for which an application for a tentative subdivision map has been deemed complete. The seller shall disclose the total installed cost of the solar energy system option, and the estimated cost savings. (This PDF is consistent with and implements MM RMDP/SCP GCC-5.)

These regulatory measures, design elements, and project design features are not included in the emissions inventory developed for the CARB 2020 No Action Taken (NAT) scenario, which is consistent with the approach and methodology established in the Assembly Bill (AB) 32 Scoping Plan.[6] These regulatory measures, design elements, and project design features are included, however, in the emissions inventory developed for the 2020 Project scenario. In addition, the report also developed a 2020 Project without PDFs scenario to show the GHG emissions reduction attributable to implementation of the design elements and project design features that exceed existing regulatory standards; in other words, the 2020 Project without PDFs scenario reflects incorporation of the identified regulatory measures but exclusion of the design elements and project design features.

Because the above regulatory measures, design elements, and project design features are quantifiable, they were incorporated in the GHG emissions estimation. A few regulations adopted on the federal and/or state level were not incorporated due to the difficulty in modeling and quantifying the reductions consistent with other analysis assumptions. They are:

[6] The only exception is the telecommuting program, which was included in both the Project and the CARB 2020 NAT scenario.

Heavy-duty Engines and Vehicles Fuel Efficiency Standards adopted by the United States Environmental Protection Agency (USEPA) and the National Highway Traffic Safety Administration (NHTSA) for model year 2014-2018 as described in Section 2.2.1.2. [7]

- Energy Independence and Security Act, which promotes the supply of renewable fuel, the production of light bulbs with higher efficiency, creation of "green jobs," etc. as described in Section 2.2.1.2.

The California Appliance Efficiency Regulations as described in Section 2.2.2.3.

Incorporating these regulations into the 2020 Project scenario would further reduce the Project's impact as compared to a CARB 2020 NAT scenario.

1.2 Existing Conditions

The Project site is generally comprised of vacant land, some agricultural uses, a small plant nursery used by the adjacent Six Flags Magic Mountain, and abandoned oil wells and associated access roads. The agricultural area, approximately 7.45 acres in size and used as pasture, would be permanently eliminated during Project buildout.[8] The Project site is periodically leased to the movie industry for set locations. All existing emission sources would be eliminated during Project buildout. Appendix A of this report describes in detail the existing land use and associated GHG emissions from those existing on-site land uses. The existing conditions emissions inventory is estimated as approximately 13.2 Metric Tonnes (MT) CO_2e per year.

[7] If incorporated, these standards would reduce the estimated emissions for the affected vehicles by 6 to 23 percent over the 2010 baselines. Available at: http://www.epa.gov/otaq/climate/documents/420f11031.pdf. Accessed: May 2014.

[8] The remaining acreage is assumed to be temporarily disturbed during Project construction.

2 Scientific Background, Regulatory Background, and Significance Thresholds

2.1 Scientific Background

There is a general scientific consensus that global climate change is occurring, caused in whole or in part by increased emissions of GHGs that keep the Earth's surface warm by trapping heat in the Earth's atmosphere, in much the same way as glass traps heat in a greenhouse. The Earth's climate is changing because human activities, primarily the combustion of fossil fuels, are altering the chemical composition of the atmosphere through the buildup of GHGs. GHGs allow the sun's radiation to penetrate the atmosphere and warm the Earth's surface, but do not let the infrared radiation emitted from the Earth escape back into outer space. As a result, global temperatures are predicted to increase over the century. In particular, if climate change remains unabated, surface temperatures in California are expected to increase anywhere from 4.1 to 8.6 degrees Fahrenheit (°F) by the end of the century. Not only would higher temperatures directly affect the health of individuals through greater risk of dehydration, heat stroke, and respiratory distress, the higher temperatures may increase ozone formation, thereby worsening air quality. Rising temperatures could also reduce the snowpack, which would increase the risk of water shortages. Higher temperatures along with reduced water supplies could reduce the quantity and quality of agricultural products. In addition, there could be an increase in wildfires and a shift in distribution of natural vegetation throughout the State. Global warming could also increase sea levels and coastal storms resulting in greater risk of flooding.

Emissions of carbon dioxide (CO_2) are the leading cause of global warming, with other pollutants such as methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons , and sulfur hexafluoride also contributing. The magnitude of the impact on global warming differs among the GHGs. For example, HFCs, perfluorocarbons, and sulfur hexafluoride have a greater "global warming potential" than CO_2. In other words, these other GHGs have a greater contribution to global warming than CO_2 on a per mass basis. The effect each GHG has on climate change is measured as a combination of the volume of its emissions, and its global warming potential (GWP), and is expressed as a function of how much warming would be caused by the same mass of CO_2. Thus, GHG emissions are typically measured in terms of megagrams or MT of CO_2e. CO_2 has the greatest impact on global warming because of the relatively large quantities of CO_2 emitted into the atmosphere.

Globally, CO_2 concentrations, which ranged from 265 parts per million (ppm) to 280 ppm over the last 10,000 years, only began rising in the last 200 years to current levels of 397 ppm, a 42 percent increase.

In 2012, the United States emitted about 6.5 billion MT (emissions not including sinks) of CO_2e[9] or about 20.5 MT/person/year, calculated by dividing by the US Census Bureau 2012 population

[9] USEPA. 2014. Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2012. Available at: http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html. Accessed: June 2014.

estimate.[10] This represents a 10 percent reduction below 2005 total emission levels. Of the four major sectors nationwide - residential, commercial, industrial and transportation - transportation accounts for the highest fraction of GHG emissions (approximately 34 percent of emissions from these four sectors); these emissions are entirely generated from direct fossil fuel combustion. Over 60 percent of the transportation emissions resulted from passenger car and light-duty truck use. The remaining emissions came from other transportation activities, including the combustion of diesel-fuel in medium- and heavy-duty vehicles and jet fuel in aircraft. According to Inventory of US Greenhouse Gas Emissions and Sinks,[11] from 2005 to 2012 transportation emissions dropped by 9 percent due, in part, to increased fuel efficiency across the US vehicle fleet, as well as higher fuel prices, and an associated decrease in the demand for passenger transportation. However, from 1990 to 2012 as a whole, transportation emissions rose by 16 percent, principally because of "increased demand for travel within limited gains in fuel efficiency" across the US vehicle fleet.[12]

In 2012, California emitted approximately 459 million tonnes of CO_2e, or about 7 percent of the US emissions.[13] California's percentage contribution is due primarily to the sheer size of California, as compared to other states. For example in 2010 (the most recently compiled data available), California had the fifth lowest per capita GHG emission rates in the country (including Washington DC)[14], due to the success of its energy-efficiency and renewable energy programs and commitments that have lowered the State's GHG emissions rate of growth.[15] Another factor that has reduced California's fuel use and GHG emissions is its mild climate compared to that of many other states.

The California Energy Commission (CEC) found that transportation is the source of approximately 41 percent of the State's GHG emissions, followed by electricity generation (both in-state and out-of-state) at 23 percent, and industrial sources at 20 percent. Agriculture and forestry is the source of approximately 8.3 percent of the State's GHG emissions. The source category "other", which includes residential and commercial activities, also comprised approximately 8.3 percent of the inventory.

The construction and operation of developments, such as Entrada South, cause GHG emissions. Operational phase GHG emissions result from energy use associated with heating, lighting and powering buildings (typically through natural gas and electricity consumption),

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[10] U.S. Census Bureau. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012 (NST-EST2012-01). September 2013. Available at: http://www.census.gov/popest/data/national/totals/2012/index.html. Accessed: June 2014.

[11] USEPA. 2014. Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2012. Available at: http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html. Accessed: June 2014.

[12] USEPA. 2014. Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2012. Available at: http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html. Accessed: June 2014.

[13] CARB. 2014. California Greenhouse Gas Inventory: 2000-2012. Available at: http://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-12_report.pdf. Accessed: June 2014.

[14] World Resources Institute, CAIT 2.0, 2014. Climate Analysis Indicators Tool: WRI's Climate Data Explorer. Washington, DC. Available at: http://cait2.wri.org/. Accessed: June 2014.

[15] The Center for Resource Efficient Communities. 2013. Residential Energy Use and GHG Emissions Impact of compact Land Use Types. Report to ARB, Contract No. 10-323. Available at: http://www.arb.ca.gov/research/apr/past/10-323h.pdf. Accessed: June 2014.

pumping and processing water, fuel used for transportation, and decomposition of waste associated with building occupants. New development can also create GHG emissions in its construction and demolition phases, including the use of fuels in construction equipment, creation and decomposition of building materials, vegetation clearing, natural gas usage, electrical usage, and transportation.

However, it is important to acknowledge that new development does not necessarily create entirely new GHG emissions, since most of the persons who will visit or occupy new development will come from other locations where they were already causing such GHG emissions. Further, it has not been demonstrated that new GHG emissions caused by a local development project can affect global climate change, or that a project's net increase in GHG emissions, if any, when coupled with other activities in the region, would be cumulatively considerable. [16]

2.1.1 Potential Effects of Human Activity on Global Climate Change

Globally, climate change has the potential to impact numerous environmental resources through anticipated, though uncertain, impacts related to future air temperatures and precipitation patterns. Scientific modeling predicts that continued GHG emissions at or above current rates would induce more extreme climate changes during the 21st century than were observed during the 20th century. A warming of about 0.2 Celsius (°C) (0.36°F) per decade is projected, and there are identifiable signs that global warming is taking place, including substantial loss of ice in the Arctic.[17]

However, the understanding of GHG emissions, particulate matter, and aerosols on global climate trends is complex and involves varying uncertainties and a balance of different effects. In addition to uncertainties about the extent to which human activity rather than solar or volcanic activity is responsible for increasing warming, there is also evidence that some human activity has cooling, rather than warming, effects, as discussed in detail in numerous publications by the International Panel on Climate Change (IPCC), such as the Fifth Assessment Report (AR5) Working Group 1 Report "The Physical Science Basis".[18,19] Nonetheless, when all effects and uncertainties are considered together, the consensus is that human activity has contributed significantly to global warming. As stated in the AR5 discussion of Attribution of Climate

[16] CAPCOA, 2008. CEQA & Climate Change. p. 35. January. Available at: http://www.capcoa.org/wp-content/uploads/downloads/2010/05/CAPCOA-White-Paper.pdf. Accessed: January, 2015.

[17] IPCC Fifth Assessment Report. Climate Change 2013: Working Group I Report: The Physical Science Basis. 2013. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf. Accessed: June 2014.

[18] The IPCC was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The IPCC has produced a series of Assessment Reports comprised of full scientific and technical assessments of climate change. The first assessment report (FAR), was developed in 1990. The Fifth Assessment report (AR5) is under development.

[19] IPCC Fifth Assessment Report. Climate Change 2013: Working Group I Report: The Physical Science Basis. . 2013. Figure SPM.5. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf. Accessed: June 2014.

Change, "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century."[20]

Acknowledging uncertainties regarding the rate at which anthropogenic GHG emissions would continue to increase (based upon various factors under human control, such as future population growth and the locations of that growth; the amount, type, and locations of economic development; the amount, type, and locations of technological advancement; adoption of alternative energy sources; legislative and public initiatives to curb emissions; and public awareness and acceptance of methods for reducing emissions), and the impact of such emissions on climate change, the IPCC devises emission scenarios which utilize various assumptions about the rates of economic development, population growth, and technological advancement over the course of the next century. For the AR5, a set of four new scenarios, denoted Representative Concentration Pathways (RCP), were developed. RCPs are based on a combination of integrated assessment models, simple climate models, atmospheric chemistry and global carbon cycle models. The four RCPs include a mitigation scenario, two stabilizing scenarios, and one scenario with very high GHG emissions. "The RCPs can thus represent a range of 21st century climate policies, as compared with the no-climate policy of the Special Report on Emissions Scenarios (SRES) used in the AR3 and the AR4."[21] .

The projected effects of global warming on weather and climate are likely to vary regionally, but are expected to include the following direct effects, according to the IPCC.[22]

It is *very likely* that the Arctic sea ice cover will continue to shrink and thin and that Northern Hemisphere spring snow cover will decrease during the 21st century as global mean surface temperature rises. Global glacier volume will further decrease;

It is virtually certain that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales as global mean temperatures increase. It is very likely that heat waves will occur with a higher frequency and duration. Occasional cold winter extremes will continue to occur;

Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except the mitigation scenario. It is *likely* to exceed 2°C for the highest forcing scenario and one stabilizing scenario, and *more likely than not* to exceed 2°C for the remaining stabilizing scenario. Warming will continue beyond 2100 under all RCP scenarios except the mitigation scenario.

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[20] IPCC Fifth Assessment Report. Climate Change 2013: Working Group I Report: The Physical Science Basis. Summary for Policymakers. Detection and Attribution of Climate Change. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf. Accessed: June 2014.

[21] IPCC Fifth Assessment Report. Climate Change 2013: Working Group I Report: The Physical Science Basis. Summary for Policymakers. Detection and Attribution of Climate Change. Box SPM.1. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf. Accessed: June 2014.

[22] IPCC Fifth Assessment Report. Climate Change 2013: Working Group I Report: The Physical Science Basis. Summary for Policymakers. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf. Accessed: June 2014.

The global ocean will continue to warm during the 21st century. Heat will penetrate from the surface to the deep ocean and affect ocean circulation;

Climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO_2 in the atmosphere (*high confidence*). Further uptake of carbon by the ocean will increase ocean acidification;

Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions; Global mean sea level will continue to rise during the 21st century;

Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond (see **Figure SPM.10**). Most aspects of climate change will persist for many centuries even if emissions of CO_2 are stopped.

Potential secondary effects from global warming include global rise in sea level, impacts to agriculture, changes in disease vectors, and changes in habitat and biodiversity.

2.1.2 Potential Effects of Climate Change on State of California

According to the CARB, some of the potential impacts in California of global warming may include loss in snow pack, sea level rise, more extreme heat days per year, more high ozone days, more large forest fires, and more drought years.[23] Several recent studies have attempted to explore the possible negative consequences that climate change, left unchecked, could have in California. These reports acknowledge that climate scientists' understanding of the complex global climate system, and the interplay of the various internal and external factors that affect climate change, remains too limited to yield scientifically valid conclusions on a localized scale. Substantial work has been done at the international and national level to evaluate climatic impacts, but far less information is available on regional and local impacts. In addition, projecting regional impacts of climate change and variability relies on large-scale scenarios of changing climate parameters, using information that is typically at too general a scale to make accurate regional assessments.[24]

Below is a summary of some of the potential effects reported in an array of studies that could be experienced in California as a result of global warming and climate change.

2.1.2.1 Air Quality

Higher temperatures, conducive to air pollution formation, could worsen air quality in California. Climate change may increase the concentration of ground-level ozone, but the magnitude of the effect, and therefore its indirect effects, are uncertain. For other pollutants, the effects of climate change and/or weather are less well studied, and even less well understood. If higher temperatures are accompanied by drier conditions, the potential for large wildfires could

[23] CARB. 2006. Public Workshop to Discuss Establishing the 1990 Emissions Level and the California 2020 Limit and Developing Regulations to Require Reporting of Greenhouse Gas Emissions, Sacramento, CA. December 1.

[24] Kiparsky, M. and P.H. Gleick. 2003. Climate Change and California Water Resources: A Survey and Summary of the Literature. Oakland, CA: Pacific Institute for Studies in Development. July 2003.

increase, which, in turn, would further worsen air quality. However, if higher temperatures are accompanied by wetter, rather than drier conditions, the rains would tend to temporarily clear the air of particulate pollution and reduce the incidence of large wildfires, thus ameliorating the pollution associated with wildfires. Additionally, severe heat accompanied by drier conditions and poor air quality could increase the number of heat-related deaths, illnesses, and asthma attacks throughout the State.[25]

2.1.2.2 Water Supply

Uncertainty remains with respect to the overall impact of global climate change on future water supplies in California. For example, models that predict drier conditions suggest decreased reservoir inflows and storage and decreased river flows, relative to current conditions. By comparison, models that predict wetter conditions project increased reservoir inflows and storage, and increased river flows.[26]

A July 2006 technical report prepared by the California Department of Water Resources (DWR) addresses the State Water Project (SWP), the Central Valley Project, and the Sacramento-San Joaquin Delta. Although the report projects that, "[c]limate change will likely have a significant effect on California's future water resources … [and] future water demand," it also reports that, "there is much uncertainty about future water demand, especially those aspects of future demand that will be directly affected by climate change and warming. While climate change is expected to continue through at least the end of this century, the magnitude and, in some cases, the nature of future changes is uncertain. This uncertainty serves to complicate the analysis of future water demand, especially where the relationship between climate change and its potential effect on water demand is not well understood".[27] DWR adds that "[i]t is unlikely that this level of uncertainty will diminish significantly in the foreseeable future."[28] Still, changes in water supply are expected to occur, and many regional studies have shown that large changes in the reliability of water yields from reservoirs could result from only small changes in inflows.[29]

2.1.2.3 Hydrology

As discussed above, climate change could potentially affect the following: the amount of snowfall, rainfall and snow pack; the intensity and frequency of storms; flood hydrographs (flash floods, rain or snow events, coincidental high tide and high runoff events); sea level rise and coastal flooding; coastal erosion; and the potential for salt water intrusion. Sea level rise can be a product of global warming through two main processes - expansion of sea water as the oceans warm and melting of ice over land. A rise in sea levels could result in coastal flooding

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[25] CCCC. 2006. Our Changing Climate: Assessing the Risks to California, CEC500-2006-077, Sacramento, CA. July. Available at: http://meteora.ucsd.edu/cap/pdffiles/CA_climate_Scenarios.pdf. Accessed: June 2014.

[26] Brekke, L.D., et al. 2004. ―Climate Change Impacts Uncertainty for Water Resources in the San Joaquin River Basin, California.‖ Journal of the American Water Resources Association. 40(2): 149–164. Malden, MA, Blackwell Synergy for AWRA.

[27] California DWR. 2006. Progress on Incorporating Climate Change into Management of California Water Resources, Sacramento, CA. July.

[28] California DWR. 2006. Progress on Incorporating Climate Change into Management of California Water Resources, Sacramento, CA. July.

[29] Kiparsky 2003, op. cit; DWR, 2005, op. cit.; Cayan, D., et al, 2006. Scenarios of Climate Change in California: An Overview (White Paper, CEC-500-2005-203-SF), Sacramento, CA. February.

and erosion and could also jeopardize California's water supply. In particular, saltwater intrusion would threaten the quality and reliability of the state's major fresh water supply that is pumped from the southern portion of the Sacramento/San Joaquin River Delta. Increased storm intensity and frequency could affect the ability of flood-control facilities, including levees, to handle storm events.

2.1.2.4 Agriculture

California has a $30 billion agricultural industry that produces half the country's fruits and vegetables. The California Climate Change Center (CCCC) notes that higher CO_2 levels can stimulate plant production and increase plant water-use efficiency. However, if temperatures rise and drier conditions prevail, water demand could increase, crop-yield could be threatened by a less reliable water supply, and greater ozone pollution could render plants more susceptible to pest and disease outbreaks. In addition, temperature increases could change the time of year that certain crops, such as wine grapes, bloom or ripen, and thus affect their quality.[30]

2.1.2.5 Ecosystems and Wildlife

Increases in global temperatures and the potential resulting changes in weather patterns could have ecological effects on a global and local scale. In 2004, the Pew Center on Global Climate Change released a report examining the possible impacts of climate change on ecosystems and wildlife.[31] The report outlines four major ways in which it is thought that climate change could affect plants and animals: (1) timing of ecological events, (2) geographic range, (3) species' composition within communities, and (4) ecosystem processes such as carbon cycling and storage.

2.2 Regulatory Setting

The following regulations relate to the calculation of the Project's GHG emissions.

2.2.1 Federal

Supreme Court Ruling in Massachusetts et al. v. Environmental Protection Agency

The Bush Administration's approach to addressing climate change was challenged in Massachusetts et al. v. Environmental Protection Agency, 549 US 497 (2007). In this decision, the US Supreme Court held that the USEPA has authority under the Clean Air Act (CAA) to regulate CO_2 emissions from new motor vehicles.[32] The Court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances in which the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change.

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[30] CCCC. 2006, op. cit.

[31] Parmesan, C. and H. Galbraith, Observed Impacts of Global Climate Change in the U.S., Arlington, VA: Pew Center on Global Climate Change, November 2004.

[32] Massachusetts, et al. v. Environmental Protection Agency. 2007. Available at: http://www.law.cornell.edu/supct/html/05-1120.ZS.html.Accessed: May 2014.

On December 7, 2009, the USEPA issued an "endangerment finding" under the Clean Air Act, concluding that GHGs threaten the public health and welfare of current and future generations and that motor vehicles contribute to GHG pollution.[33] These findings provide the basis for adopting new national regulations to mandate GHG emission reductions under the federal Clean Air Act.

It was expected that Congress would enact GHG legislation, primarily for a cap-and-trade system. However, proposals circulated in both the House of Representative and Senate were controversial and it may be some time before Congress adopts major climate change legislation.

That being said, under the Consolidated Appropriations Act of 2008 (HR 2764), Congress established mandatory GHG reporting requirements for some emitters of GHGs. In addition, on September 22, 2009, the USEPA issued the Final Mandatory Reporting of Greenhouse Gases Rule. The rule requires annual reporting to the USEPA of GHG emissions from large sources and suppliers of GHGs, including facilities that emit 25,000 MT or more a year of GHGs. Based on the applicability criteria listed in the rule (40 CFR Part 98), mandatory reporting is only required for certain large industrial and commercial sources of GHGs.

The Project does not meet any of the criteria requiring mandatory GHG reporting.

2.2.1.1 Mobile Sources

USEPA and NHTSA Joint Rulemaking for Vehicle Standards

In response to the Massachusetts v. EPA ruling discussed above, the Bush Administration issued an Executive Order on May 14, 2007, directing the USEPA, the Department of Transportation (DOT), and the Department of Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008.

On October 10, 2008, the NHTSA released a final environmental impact statement analyzing proposed interim standards for passenger cars and light trucks in model years 2011 through 2015. The NHTSA issued a final rule for model year 2011 on March 30, 2009.[34] And, on May 7, 2010, the USEPA and the NHTSA issued a final rule regulating fuel efficiency and GHG pollution from motor vehicles for cars and light-duty trucks for model years 2012–2016.[35]

On May 21, 2010, President Obama issued a memorandum to the Secretaries of Transportation and Energy, and the Administrators of the USEPA and the NHTSA calling for establishment of

[33] USEPA. 2009. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. Available at: http://www.epa.gov/climatechange/endangerment/. Accessed: May 2014.

[34] NHTSA. 2009. Laws & Regulations, CARE - Fuel Economy, Average Fuel Economy Standards Passenger Cars and Light Trucks Model Year 2011, Final Rule. March 23. Available at: http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/CAFE_Updated_Final_Rule_MY2011.pdf. Accessed: May 2014.

[35] USEPA. 2010. Light Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, Final Rule. May 7. Available at: https://www.federalregister.gov/articles/2010/05/07/2010-8159/light-duty-vehicle-greenhouse-gas-emission-standards-and-corporate-average-fuel-economy-standards. Accessed May 2014.

additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure.[36] In response to this directive, USEPA and NHTSA issued a Supplemental Notice of Intent announcing plans to propose stringent, coordinated federal GHG and fuel economy standards for model year 2017-2025 light-duty vehicles.[37] The agencies proposed standards projected to achieve 163 grams/mile of CO_2 in model year 2025, on an average industry fleet wide basis, which is equivalent to 54.5 miles per gallon (mpg) if this level were achieved solely through fuel efficiency. California has announced its support of this national program.[38] The final rule was adopted in October 2012 for model years 2017-2021, and NHSTA intends to set standards for model years 2022-2025 in a future rulemaking.[39,40]

Heavy-Duty Engines and Vehicles Fuel Efficiency Standards

In addition to the regulations applicable to cars and light-duty trucks, on August 9, 2011, the USEPA and the NHTSA announced fuel economy and GHG standards for medium- and heavy-duty trucks, which apply to vehicles from model year 2014-2018.[41] USEPA and NHTSA have adopted standards for CO_2 emissions and fuel consumption, respectively, tailored to each of three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. According to USEPA, this program will reduce GHG emissions and fuel consumption for affected vehicles by 6 percent to 23 percent over the 2010 baselines.

These emissions reductions were not included in the Project emissions inventory due to the difficulty in quantifying the reductions consistent with other analysis assumptions. Excluding these reductions results in a more conservative (i.e., higher) Project emissions inventory.

Energy Independence and Security Act

On December 19, 2007, the Energy Independence and Security Act of 2007 (EISA) was signed into law.[42] Among other key measures, the Act will do the following, which would aid in the reduction of national GHG emissions, both mobile and non-mobile:

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[36] GPO. 2010. Federal Register, Vol. 75, No. 101, Presidential Documents, Improving Energy Security, American Competitiveness and Job Creation, and Environmental Protection Through a Transformation of Our Nation's Fleet of Cars and Trucks. May 21. Available at: http://www.gpo.gov/fdsys/pkg/FR-2010-05-26/html/2010-12757.htm. Accessed: May 2014.

[37] GPO. 2011. Federal Register, Vol. 76, No. 153, Proposed Rules, 2017-2025 Model Year Light-Duty Vehicle GHG Emissions and CAFÉ Standards: Supplemental Notice of Intent. August 9. Available at: http://gpo.gov/fdsys/pkg/FR-2011-08-09/pdf/2011-19905.pdf. Accessed: May 2014.

[38] CARB. 2011. Commitment Letter to National Program, July 28. Available at: http://www.epa.gov/otaq/climate/letters/carb-commitment-ltr.pdf. Accessed: May 2014.

[39] NHTSA. 2012. Federal Register, Vol. 77, No. 199, Rules & Regulations, 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, effective December 14, 2012. Available at: https://federalregister.gov/a/2012-21972. Accessed: May 2014.

[40] NHTSA. 2012. Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2017-2025, Final Environmental Impact Statement, July. Available at: http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FINAL_EIS.pdf. Accessed: May 2014.

[41] USEPA. 2011. Office of Transportation and Air Quality. EPA and NHTSA Adopt First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium-and Heavy-Duty Vehicles. August. Available at: http://www.epa.gov/otaq/climate/documents/420f11031.pdf. Accessed: May 2014.

[42] GPO. 2007. Energy Independence and Security Act of 2007. January 4. Available at: http://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf. Accessed: May 2014.

Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.

Prescribe or revise standards affecting regional efficiency for heating and cooling products, procedures for new or amended standards, energy conservation, energy efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Require approximately 25 percent greater efficiency for light bulbs, by phasing out the incandescent light bulbs between 2012 and 2014; require approximately 200 percent greater efficiency for light bulbs, or similar energy savings, by 2020.

While superseded by NHTSA and USEPA actions described above, EISA also set mpg targets for cars and light trucks and directed the NHTSA to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.

Additional provisions of the EISA address energy savings in government and public institutions, promoting research for alternative energy, additional research in carbon capture, international energy programs, and the creation of “green jobs”.

2.2.2 State

Executive Order No. S-3-05

On June 1, 2005, Governor Schwarzenegger signed Executive Order No. S-3-05, which established the following GHG emission reduction goals for California: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; and, by 2050, reduce GHG emissions to 80 percent below 1990 levels. It also instructed the Secretary of the California Environmental Protection Agency to coordinate with other state agencies and report to the Governor and Legislature by January 2006 (and biannually thereafter) on progress made toward meeting the specified GHG emission reduction goals and the impacts of global climate change on California.

In adopting the 2006 Global Warming Solutions Act (AB 32), the Legislature did not include the Executive Order’s 2050 horizon-year goal, but rather exclusively codified the 2020 goal; and, in the last legislative session, the Legislature rejected proposals to legislatively enact the 2050 goal.[43]

Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006 (AB 32) was signed into law in September 2006 after considerable study and expert testimony before the Legislature. The law instructs the CARB to develop and enforce regulations for the reporting and verifying of statewide GHG emissions. The Act directed CARB to set a GHG emission limit based on 1990 levels, to be

[43] See Cleveland National Forest Foundation v. San Diego Association of Governments (2014) 231 Cal.App.4th 1056, 1096; Professional Engineers in California Government v. Schwarzenegger (2010) 50 Cal.4th 989, 1015; Office of Planning and Research, Guide to the California State Executive Branch (Oct. 2004), p. 8.

achieved by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.[44]

The heart of the bill is the requirement that statewide GHG emissions be reduced to 1990 levels by 2020. The bill required CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. CARB accomplished the key milestones set forth in AB 32, including the following:

June 30, 2007. Identification of discrete early action GHG emissions reduction measures. On June 21, 2007, CARB satisfied this requirement by approving three early action measures.[45] These were later supplemented by adding six other discrete early action measures.[46]

January 1, 2008. Identification of the 1990 baseline GHG emissions level and approval of a statewide limit equivalent to that level and adoption of reporting and verification requirements concerning GHG emissions. On December 6, 2007, CARB approved a statewide limit on GHG emissions levels for the year 2020 consistent with the determined 1990 baseline.[47]

January 1, 2009. Adoption of a scoping plan for achieving GHG emission reductions. On December 11, 2008, CARB adopted the Climate Change Scoping Plan: A Framework for Change (Scoping Plan), discussed in more detail below.[48]

January 1, 2010. Adoption and enforcement of regulations to implement the “discrete” actions. Several early action measures were adopted and became effective on January 1, 2010.[49,50]

January 1, 2011. Adoption of GHG emissions limits and reduction measures by regulation. On October 28, 2010, CARB released its proposed cap-and-trade regulations, which cover sources of approximately 85 percent of California's GHG emissions.[51] CARB's Board ordered CARB's

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[44] Legislative Counsel of California. 2006. California Assembly Bill 32. September. Available at: http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf. Accessed: May 2014.

[45] CARB. 2007. Summary of Board Meeting, Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. June 21-22. Available at: http://www.arb.ca.gov/board/ms/2007/ms062107.pdf. Accessed: May 2014.

[46] CARB. 2007. Summary of Board Meeting, Public Meeting to Consider Approval of Additions to Reduce Greenhouse Gas Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. October 25-26. Available at: http://www.arb.ca.gov/board/ms/2007/ms102507.pdf. Accessed: May 2014.

[47] CARB. 2007. Staff Report, California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit. November 16. Available at: http://www.arb.ca.gov/cc/inventory/pubs/reports/staff_report_1990_level.pdf. Accessed: May 2014.

[48] CARB. 2008. Climate Change Scoping Plan. December. Available at: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed: August 22, 2013.

[49] CARB. 2007. Summary of Board Meeting, Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. June 21-22. Available at: http://www.arb.ca.gov/board/ms/2007/ms062107.pdf. Accessed: May 2014.

[50] CARB. 2007. Summary of Board Meeting, Public Meeting to Consider Approval of Additions to Reduce Greenhouse Gas Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. October 25-26. Available at: http://www.arb.ca.gov/board/ms/2007/ms102507.pdf. Accessed: May 2014.

[51] CARB. 2010. Proposed Regulation to Implement the California Cap-and-Trade Program, December 16. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm. Accessed: May 2014.

Executive Director to prepare a final regulatory package for cap-and-trade on December 16, 2010.[52]

January 1, 2012. GHG emissions limits and reduction measures adopted in 2011 become enforceable.

As noted above, on December 11, 2008, CARB adopted the Scoping Plan to achieve the goals of AB 32. The Scoping Plan establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions for various emission sources/sectors. In the Scoping Plan, CARB determined that achieving the 1990 emission level in 2020 would require a reduction in GHG emissions of approximately 28.5 percent in the absence of new laws and regulations (referred to as “business as usual” [BAU] or NAT). The Scoping Plan evaluates opportunities for sector-specific reductions, integrates all CARB and Climate Action Team early actions and additional GHG reduction measures by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program. The key elements of the Scoping Plan include:[53]

Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;

Achieving a statewide renewable energy mix of 33 percent;

Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85 percent of California's GHG emissions;

Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;

Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the LCFS; and

Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation.

In connection with its preparation of the August 2011 Final Supplement to the Scoping Plan’s Functional Equivalent Document, CARB released revised estimates of the 2020 emissions level projection in light of the economic recession and the availability of updated information from development of measure-specific regulations. Based on the new economic data, CARB determined the 2020 emissions level projection in the BAU condition would be reduced from 596 metric tonnes of CO_2 equivalent ($MTCO_2e$) to 545 $MTCO_2e$.[54] Under this scenario then,

[52] CARB. 2010. California Cap-and-Trade Program, Resolution 10-42. December 16. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/res1042.pdf. Accessed: May 2014.

[53] CARB. 2008. Climate Change Scoping Plan. December. Available at: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. page 12. Accessed: May 2014.

[54] CARB. 2011. Status of Scoping Plan Recommended Measures. July 25. Available at: http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf. Accessed: May 2014.

achieving the 1990 emissions level in 2020 would require a reduction of GHG emissions of 118 $MTCO_2e$, or 21.7 percent (down from 28.5 percent), from the BAU condition.

When the 2020 emissions level projection also was updated to account for implemented regulatory measures, including Pavley (vehicle model-years 2009 - 2016) and the renewable portfolio standard (12 - 20 percent), the 2020 projection in the BAU condition was reduced further to 507 $MTCO_2e$. As a result, based on the updated economic and regulatory data, CARB determined that achieving the 1990 emissions level in 2020 would now only require a reduction of GHG emissions of 80 $MTCO_2e$, or approximately 16 percent (down from 28.5 percent), from the BAU condition.[55,56]

On February 10, 2014, CARB released a discussion draft first update to the Scoping Plan. The Board approved the final "First Update to the Climate Change Scoping Plan" on May 22, 2014. The First Update describes California's progress towards AB32 goals, stating that California is on track to meet the near-term 2020 greenhouse gas limit and is well positioned to maintain and continue reductions beyond 2020. Specifically, the First Update states that "if California realizes the expected benefits of existing policy goals (such as 12,000 megawatts [MW] of renewable distributed generation by 2020, net zero energy homes after 2020, existing building retrofits under AB 758, and others) it could reduce emissions by 2030 to levels squarely in line with those needed in the developed world and to stay on track to reduce emissions to 80 percent below 1990 levels by 2050."[57] The First Update recalculates 1990 GHG emissions using IPCC AR4 released in 2007. Using the AR4 global warming potentials GWPs, the 427 $MTCO_2e$ 1990 emissions level and 2020 GHG emissions limit would be slightly higher, at 431 $MTCO_2e$.[58] Based on the revised estimates of expected 2020 emissions identified in the First Update to the Scoping Plan, which take into account reductions from measures currently in place, achieving the 1990 emission level would require a reduction of 78 $MTCO_2e$ or a reduction of approximately 15 percent to achieve in 2020 emissions levels in the BAU or NAT condition.[59,60,61,62]

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[55] CARB. 2011. Status of Scoping Plan Recommended Measures. July 25. Available at: http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf. Accessed: May 2014.

[56] CARB. 2011. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. Available at: http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf. Accessed: May 2014.

[57] CARB. First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: June 2014.

[58] CARB. First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: June 2014.

[59] For comparison, the 2008 Scoping Plan calculation of the emissions reductions required by 2020 compared to the BAU scenario was169 $MTCO_2e$ or 28.5%, calculated using GWPs from the IPCC Second Assessment Report SAR and assuming no reductions in the BAU scenario. This was updated to 118 MTCO2e, or a reduction of 21.7% taking into account the effects of the economic recession. An estimate which takes into account the reductions due to measures currently in place, including Pavley 1 and the Renewable Portfolios Standard was published in This in the Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document (FED 2011). The necessary reduction calculated in the FED was 80 $MTCO_2e$ or approximately 16%.

[60] CARB. Status of Scoping Plan Recommended Measures, July 25, 2011. Available at: http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf. Accessed: May 2014.

In conjunction with the First Update, CARB identified "six key focus areas comprising major components of the State's economy to evaluate and describe the larger transformative actions that will be needed to meet the State's more expansive emission reduction needs by 2050." Those six areas are: (1) energy; (2) transportation (vehicles/equipment, sustainable communities, housing, fuels, and infrastructure); (3) agriculture; (4) water; (5) waste management; and, (6) natural and working lands. The First Update identifies key recommended actions for each sector that will facilitate achievement of the 2050 reduction target.

Based on CARB's research efforts, it has a "strong sense of the mix of technologies needed to reduce emissions through 2050." Those technologies include energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings and industrial machinery; decarbonizing electricity and fuel supplies; and, the rapid market penetration of efficient and clean energy technologies.

The First Update also includes a strong recommendation for setting a mid-term statewide emission reduction target: "Setting a strong mid-term target that aligns with scientifically established needs is an important next step in California's climate policy leadership." The mid-term target should be consistent with the United States' pledge to reduce emissions 42 percent below 2005 levels (translating to 35 percent reductions below 1990 levels for California) and with the State's long term goal of an emissions limit 80 percent below 1990 levels by 2050. The First Update recommends that all sectors set a mid-term (2030) target to meet the State mid-term target when it is defined.[63] The First Update includes a discussion of new residential and commercial building energy efficiency improvements and progress towards zero net energy buildings as a key element of meeting mid-term and long term goals, stating that "[C]ARB is committed to building upon the recent policies and goals adopted by the California Public Utilities Commission (CPUC) and CEC and supporting the development of statewide programs, such that all new residential and commercial buildings are zero net energy by 2020 and 2030, respectively." The First Update sets forth recommended actions for green buildings, including strengthening the next two editions of the Green Building Standards with mandatory provisions for 2017 and 2020 emissions and establishing target dates and pathways towards transitioning to zero net carbon buildings that expand on existing zero net energy (ZNE) goals.[64]

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[61] CARB. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. Available at: http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf. Accessed: May 2014.

[62] California Air Resources Board, First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: June 2014.

[63] California Air Resources Board, First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: June 2014.

[64] California Air Resources Board, First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: June 2014.

2.2.2.1 Energy-Related Sources

Renewable Portfolio Standards (SB 1078, SB 107 and SBX1-2)

Established in 2002 under Senate Bill (SB 1078), and accelerated in 2006 under SB 107 and again in 2011 under SBX1-2, California's RPS requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020.[65,66,67] The 33 percent standard is consistent with the RPS goal established in the Scoping Plan.[68] As interim measures, the RPS requires 20 percent of retail sales to be sourced from renewable energy by 2013, and 25 percent by 2016. Initially, the RPS provisions applied to investor-owned utilities, community choice aggregators, and electric service providers. SBX1-2 added, for the first time, publicly owned utilities to the entities subject to RPS.[69]

The expected growth in RPS to meet the standards in effect in 2008 is not reflected in the BAU calculation in the AB 32 Scoping Plan, discussed below. In other words, the Scoping Plan's BAU 2020 does not take credit for implementation of RPS that occurred after its adoption.[70]

2.2.2.2 Mobile Sources

Mobile Source Reductions (AB 1493)

AB 1493 ("the Pavley Standard" or AB 1493) required CARB to adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light-duty trucks of model year 2009 through 2016. The bill also required the California Climate Action Registry (CCAR) to develop and adopt protocols for the reporting and certification of GHG emissions reductions from mobile sources for use by CARB in granting emission reduction credits. The bill authorizes CARB to grant emission reduction credits for reductions of GHG emissions prior to the date of enforcement of regulations, using model year 2000 as the baseline for reduction.

In 2004, CARB applied to the USEPA for a waiver under the federal CAA to authorize implementation of these regulations. The waiver request was formally denied by the USEPA in December 2007 after California filed suit to prompt federal action. In January 2008, however, the State Attorney General filed a new lawsuit against the USEPA for denying California's request for a waiver to regulate and limit GHG emissions from these vehicles. In January 2009,

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[65] Legislative Counsel of California. 2002. Senate Bill 1078. September. Available at: http://www.energy.ca.gov/portfolio/documents/documents/SB1078.PDF. Accessed: May 2014.

[66] Legislative Counsel of California. 2006. Senate Bill 1368, September 2006. Available at: http://www.energy.ca.gov/emission_standards/documents/sb_1368_bill_20060929_chaptered.pdf. Accessed: May 2014.

[67] California Air Resources Board, et al., v. Association of Irritated Residents, et al. 2011. Available at: http://www.crpe-ej.org/crpe/images/stories/7.25.11_Petition_for_Review_FINAL_with_Exhibits_smaller_version.pdf. Accessed: May 2014.

[68] CARB. 2008. Climate Change Scoping Plan. December. Available at: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed: May 2014.

[69] California Air Resources Board, et al., v. Association of Irritated Residents, et al. 2011. Available at: http://www.crpe-ej.org/crpe/images/stories/7.25.11_Petition_for_Review_FINAL_with_Exhibits_smaller_version.pdf. Accessed: May 2014.

[70] CARB. 2008. Climate Change Scoping Plan Appendices, Vol. I. December. Available at: http://www.arb.ca.gov/cc/scopingplan/document/appendices_volume1.pdf. Accessed: May 2014.

President Barack Obama issued a directive to the USEPA to reconsider California's request for a waiver. On June 30, 2009, the USEPA granted the waiver to California for its GHG emission standards for motor vehicles. As part of this waiver, USEPA specified the following provision: CARB may not hold a manufacturer liable or responsible for any noncompliance caused by emission debits generated by a manufacturer for the 2009 model year.

CARB has adopted a new approach to passenger vehicles (cars and light trucks) by combining the control of smog-causing pollutants and GHG emissions into a single coordinated package of standards. The new approach also includes efforts to support and accelerate the numbers of plug-in hybrids and zero-emission vehicles in California. These standards will apply to all passenger and light duty trucks used by customers, employees of and deliveries to the Project.

Low Carbon Fuel Standard

Executive Order S-01-07 (January 18, 2007) requires a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by CARB. CARB identified the “low carbon fuel standard,” or LCFS as a Discrete Early Action item under CARB’s AB 32 Scoping Plan, and the final resolution (09-31) was issued on April 23, 2009.[71] In 2009, CARB approved for adoption the LCFS regulation, which became fully effective in April 2010 and is codified at Title 17, CCR, Sections 95480-95490. The LCFS will reduce greenhouse gas emissions by reducing the carbon intensity of transportation fuels used in California by at least 10 percent by 2020. (Carbon intensity is a measure of the GHG emissions associated with the various production, distribution, and use steps in the “lifecycle” of a transportation fuel.)

On December 29, 2011, the US District Court for the Eastern District of California issued several rulings in the federal lawsuits challenging the LCFS. One of the district court's rulings preliminarily enjoined the CARB from enforcing the regulation. In January 2012, CARB appealed that decision to the Ninth Circuit Court of Appeals. On September 18, 2013, the Ninth Circuit concluded that the LCFS ethanol and initial crude-oil provisions are not facially discriminatory, but remanded the case to the district court to determine whether the LCFS ethanol provisions are discriminatory in purpose and effect. Additionally, the Ninth Circuit remanded to the District Court with instructions to vacate the preliminary injunction against CARB's enforcement of the regulation.

In a mostly-published 95-page opinion filed July 15, 2013, the Fifth District Court of Appeal reversed a trial court’s judgment and directed issuance of a writ of mandate setting aside Resolution 09-31 and two executive orders of the CARB approving LCFS regulations promulgated to reduce GHG emissions. (POET, LLC v. CARB (2013) 217 Cal.App.4th 1214.) However, despite its finding that CARB’s actions “ran afoul of several procedural requirements imposed by California Environmental Quality Act (CEQA) and the APA” and that “these procedural violations are not trivial,” the Court tailored its remedy to protect the public interest by “allow[ing] the LCFS regulations to remain operative while [C]ARB complies with the procedural requirements it failed to satisfy.” It stated: “In other words, we will avoid the irony of violations of

[71] CARB. 2009. Initial Statement of Reason for Proposed Regulation for The Management of High Global Warming Potential Refrigerant for Stationary Sources. October 23. Available at: http://www.arb.ca.gov/regact/2009/gwprmp09/isorref.pdf. Accessed: May 2014.

an environmental protection statute being used to set aside a regulation that restricts the release of pollutants into the environment."

Advanced Clean Cars[72]

In January 2012, CARB approved the ACCs Program, a new emissions-control program for model year 2017 through 2025. The program combines the control of smog, soot, and GHGs with requirements for greater numbers of zero-emission vehicles. By 2025, when the rules will be fully implemented, the new automobiles will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions.

Senate Bill 375 and SCAG Regional Transportation Plan/Sustainable Community Plan

SB 375 provides for a new planning process to coordinate land use planning, regional transportation plans, and funding priorities to reduce GHG emissions from passenger vehicles through better-integrated regional transportation, land use, and housing planning that provides easier access to jobs, services, public transit, and active transportation options.[73] SB 375 includes provisions for streamlined CEQA review for some infill projects, such as transit oriented development. SB 375 also requires the Metropolitan Planning Organization (MPO) relevant to the Project area (i.e., the Southern California Association of Governments [SCAG]) to incorporate a "sustainable communities strategy" (SCS) into its regional transportation plan (RTP) that will achieve GHG emission reduction targets by reducing vehicle miles traveled (VMT) from light-duty passenger vehicles through the development of more compact, complete, and efficient communities.

The Scoping Plan, adopted by CARB in December of 2008, relies on the requirements of SB 375 to implement the carbon emissions reductions anticipated from land use decisions.

On September 23, 2010, CARB adopted Regional Targets for the reduction of GHGs applying to the years 2020 and 2035.[74] For the area under SCAG's jurisdiction—including the Project area—CARB adopted Regional Targets for reduction of GHG emissions by 8 percent for 2020 and by 13 percent for 2035. On February 15, 2011, CARB's Executive Officer approved the final targets.[75]

SCAG's SCS is included in the SCAG 2012-2035 Regional Transportation Plan Sustainable Communities Strategy (RTP/SCS). The document was adopted by SCAG in April 2012. The goals and policies of the RTP/SCS that reduce VMT focus on transportation and land use

[72] Advanced Clean Car program information. Available at: http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm. Accessed: May 2014

[73] California Air Resources Board, First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: January 2015.

[74] CARB. 2010. Notice of Decision: Regional Greenhouse Gas Emissions Reduction Targets for Automobiles and Light Trucks Pursuant to Senate Bill 375. Sacramento, CA: CARB. Available at: http://www.arb.ca.gov/cc/sb375/notice%20of%20decision.pdf. Accessed: May 2014

[75] CARB. 2011. Executive Order No. G-11-024: Relating to Adoption of Regional Greenhouse Gas Emission Reduction Targets for Automobiles and Light Trucks Pursuant to Senate Bill 375. Sacramento, CA: CARB. February.

planning that include building infill projects, locating residents closer to where they work and play, and designing communities so there is access to high quality transit service. The 2012-2035 RTP/SCS is expected to reduce per capital transportation emissions of 9 percent in 2020 and 16 percent in 2035. In June 2012, CARB accepted SCAG's determination that the Final RTP/SCS would meet the region's GHG reduction target.

Pursuant to Government Code Section 65080(b)(2)(K), SCAG's Sustainable Communities Strategy does not: (i) regulate the use of land, (ii) supersede the land use authority of cities and counties; or (iii) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it. Nonetheless, SB 375 makes regional and local planning agencies responsible for developing Sustainable Communities Strategy plans as part of the federally required metropolitan transportation planning process and the state-mandated housing element process.[76]

2.2.2.3 Building Standards

Green Building Code (California Code of Regulations [CCR], Title 24)

Energy Conservation Standards for new residential and commercial buildings were originally adopted by the California Energy Resources Conservation and Development Commission in June 1977 and most recently revised in 2013 (Title 24 CCR Part 6 [CCR, 2013]). In general, Title 24 requires the design of building shells and building components to conserve energy. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods.

The 2006 Appliance Efficiency Regulations (Title 20 CCR §1601-1608), dated December 2006, were adopted by the California Energy Commission on October 11, 2006, and approved by the California Office of Administrative Law on December 14, 2006. The regulations were then amended on January 12, 2012 and became effective on February 1, 2013. The regulations include standards for both federally-regulated appliances and non-federally regulated appliances. The 2006 regulations are now often seen as BAU in California, but they do exceed the standards imposed by any other state and reduce GHG emissions by reducing energy demand. The 2013 regulations further reduce GHG emissions associated with these appliances. However, because California Emission Estimator Model® (CalEEMod®) employs energy usage data reported in the Residential Appliance Saturation Survey (RASS) and California Commercial End-Use Survey (CEUS), both of these Appliance Efficiency Regulations were not included in the analysis. Including the 2006 regulations for BAU and the 2013 regulations for Project will further reduce the Project's impact as compared to a CARB 2020 NAT projection.

On July 17, 2008, the California Building Standards Commission adopted the nation's first green building standards. The CalGreen (proposed Part 11, Title 24) was adopted as part of the California Building Standards Code (Title 24 CCR). Part 11 establishes voluntary standards on planning and design for sustainable site development, energy efficiency (in excess of the

[76] California Air Resources Board, First Update to the Climate Change Scoping Plan. May 2014. Available at: http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf. Accessed: January 2015.

California Energy Code requirements), water conservation, material conservation, and internal air contaminants. Some of these standards have become mandatory in the 2010 edition of the Part 11 Code.[77]

The California Energy Commission has adopted changes to the 2013 Building Energy Efficiency Standards contained in Title 24 CCR Part 6 (also known as the California Energy Code), and associated administrative regulations in Part 1 (collectively referred to here as the Standards). The 2013 Building Energy Efficiency Standards are 25 percent more efficient than previous standards for residential construction and 30 percent better for nonresidential construction.[78] The standards, which take effect on July 1, 2014, will offer builders better windows, insulation, lighting, ventilation systems and other features that reduce energy consumption in homes and businesses.

2.2.2.4 Waste Diversion

California Integrated Waste Management Act of 1989

The California Integrated Waste Management Act of 1989 (Public Resources Code Sections 40000 et seq.) requires each jurisdiction's source reduction and recycling element to include an implementation schedule that shows (1) diversion of 25 percent of all solid waste by January 1, 1995, through source reduction, recycling, and composting activities; and (2) diversion of 50 percent of all solid waste on and after January 1, 2000, through source reduction, recycling, and composting facilities.[79] Additionally, jurisdictions are not prohibited from implementing source reduction, recycling, and composting activities designed to exceed these requirements.[80]

AB 341 (2011) amended the California Integrated Waste Management Act of 1989 to include a provision declaring that it is the policy goal of the state that not less than 75 percent of solid waste generated be source reduced, recycled, or composted by the year 2020, and annually thereafter.[81] In addition, AB 341 required the California Department of Resources Recycling and Recovery (CalRecycle) to develop strategies to achieve the state's policy goal.[82] CalRecycle conducted several stakeholder workshops and published a discussion document in May 2012 titled California's New Goal: 75 Percent Recycling, which identifies concepts that CalRecycle believes would assist the state in reaching the 75 percent goal by 2020.[83]

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[77] California Building Standards Commission. 2010. California Green Building Standards Code, California Code of Regulations, Title 24, Part 11, effective January 1, 2011. Available at: http://www.bsc.ca.gov/Home/CALGreen.aspx. Accessed: May 2014.

[78] Available at: http://www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html. Accessed: May 2014

[79] Cal. Pub. Res. Code § 41780(a).

[80] Cal. Pub. Res. Code § 41780(b).

[81] Cal. Pub. Res. Code § 41780.01(a).

[82] Cal. Pub. Res. Code § 41780.02.

[83] Available at: http://www.calrecycle.ca.gov/75percent/Plan.pdf . Accessed: May 2014.

2.2.2.5 Carbon Markets

As discussed above, CARB has established a cap-and-trade program[84] that is enforceable and meets the requirements of AB 32. Cap-and-trade is a market based regulation that is designed to reduce GHGs from multiple sources. Cap-and-trade sets a firm limit or "cap" on GHGs and minimizes the compliance costs of achieving AB 32 goals. The program started on January 1, 2012, with an enforceable compliance obligation beginning with the 2013 GHG emissions. The cap will decline approximately 3 percent each year beginning in 2013. Trading creates incentives to reduce GHGs below allowable levels through investments in clean technologies. With a carbon market, a price on carbon is established for GHGs. Market forces spur technological innovation and investments in clean energy.

As part of the cap-and-trade program, CARB will hold quarterly allowance auctions and reserve sales to allow market participants to acquire allowances directly from CARB. Auction participants apply to participate in an auction or reserve sale or confirm their intent to bid, submit a bid guarantee, and meet financial regulatory requirements in order to participate in an auction or reserve sale. CARB held the first auction in November 2012, and has held six subsequent auctions.

CARB also allows the use of compliance offsets in the cap-and-trade program.[85] The current CARB-approved Offset Project Registries include American Carbon Registry (ACR)[86] and Climate Action Reserve (CAR).[87] An offset represents a reduction or removal of GHGs. For the CARB program, these offsets must be measured, quantified, and verified.

The CAPCOA has also introduced the Greenhouse Gas Reduction Exchange (GHG R_X).[88] GHG R_X is intended to provide a trusted source of GHG credits that may be used to mitigate GHG emissions for CEQA and USPEA purposes. This exchange will operate similarly to the Offset Project Registries discussed above, which will require any credits be measured, quantified and verified.

2.2.3 Regional

2.2.3.1 South Coast Air Quality Management District Policies

SCAQMD is principally responsible for comprehensive air pollution control in the South Coast Air Basin (SCAB), which includes Los Angeles, Orange, and the urbanized portions of Riverside and San Bernardino Counties, including the Project site. SCAQMD works directly with SCAG, County transportation commissions, and local governments and cooperates actively with all federal and State government agencies to regulate air quality.

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[84] Information presented here was obtained from CARB. Available at: http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm. Accessed: May 2014.

[85] Available at: http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm. Accessed: May 2014.

[86] Available at: http://americancarbonregistry.org/. Accessed: May 2014.

[87] Available at: http://www.climateactionreserve.org/. Accessed: May 2014.

[88] Available at: http://www.ghgrx.org/. Accessed: May 2014.

In April 2008, SCAQMD convened a Working Group to develop GHG significance thresholds for CEQA. On December 5, 2008, the SCAQMD Governing Board adopted its staff proposal for an interim CEQA GHG significance threshold for projects where the SCAQMD is the lead agency. As to all other projects, where the SCAQMD is not the lead agency, the Board has, to date, only adopted an interim threshold of 10,000 $MTCO_2e$ per year for industrial stationary source projects.[89]

For all other projects, SCAQMD staff developed a draft multi-tier analysis to determine the appropriate threshold to be used. In general, staff's draft includes the following tiers: Tier 1 is any applicable CEQA exemption, Tier 2 is consistency with a GHG reduction plan, Tier 3 is a screening value or bright line, Tier 4 is a performance based standard, and Tier 5 is GHG mitigation offsets.[90]

According to the staff presentation given at the September 28, 2010 Working Group meeting, SCAQMD staff specifically identified the following draft tiers:[91]

Tier 1: Determine if CEQA categorical exemptions are applicable. If not move to Tier 2;

Tier 2: Consider whether or not the proposed project is consistent with a locally adopted GHG reduction plan (often called a Climate Action Plan) that has gone through public hearings and CEQA review, which has an approved inventory that includes monitoring, etc. If not move to Tier 3;

Tier 3: For all land use types, if projects are less than 3,000 $MTCO_2e$/year, the project is presumed to be less than significant for GHGs. If the project exceeds 3,000 $MTCO_2e$/year; move to Tier 4. More specific screening thresholds were also provided, which include 1,400 $MTCO_2e$/year for commercial projects and 3,500 $MTCO_2e$/year for residential and mixed use projects. These thresholds were based on a review of the Office of Planning and Research database which included 711 CEQA projects using a 90 percent capture approach;

Tier 4: The proposed performance standards include three options:

1. Percent Emission Reduction Target[92]
2. Early Implementation of Applicable AB 32 Scoping Plan Measures
3. SCAQMD Efficiency Target

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[89] SCAQMD. 2008. Board Meeting Date: December 5, 2008, Agenda No. 31, Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans for use by the AQMD. Available at: http://www.aqmd.gov/home/governing-board/agendas-minutes. Accessed: May 2014.

[90] SCAQMD. 2008. Board Meeting Date: December 5, 2008, Agenda No. 31, Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans for use by the AQMD, website. Available at: http://www.aqmd.gov/home/governing-board/agendas-minutes. Accessed: May 2014.

[91] SCAQMD. 2010. CEQA Significance Thresholds Working Group Meeting #15. September 28. Available at: http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-15/ghg-meeting-15-main-presentation.pdf?sfvrsn=2. Accessed: July 2014.

[92] The Tier 4 percent emission reduction target is linked to a percent reduction target that is based on consistency with AB 32, as it was based on the same numeric reductions calculated in the Scoping Plan to reach 1990 levels by 2020.

For option 3, there are targets for 2020 and 2035.

The proposed 2020 target is:

- 4.8 MT/year CO_2e per service population for project level threshold (land use employment only)

6.6 MT/year CO_2e per service population for plan level threshold

The proposed 2035 target is:

- 3.0 MT/year CO_2e per service population for project level threshold
- 4.1 MT/year CO_2e per service population for plan level threshold

Incorporate Sustainable Communities and Climate Protection Act of 2008 or SB 375 regional targets.

Tier 5: Off-site mitigation for life of project (30 years). If this threshold is to be used, GHG emissions must be mitigated to less than the Tier 3 screening significance threshold. The SCAQMD clarified that offsets should have a 30 year project life, should be real, quantifiable, verifiable, and surplus and will be considered in the following prioritized manner:

- Project design feature/onsite reduction measures
- Offsite within neighborhood
- Offsite within district
- Offsite within state
- Offsite out of state

Substitution allowed via enforceable commitment (e.g. when an offset project ends prematurely).

If the proposed project cannot meet any of the Tiers, it is presumed to be significant for GHG emissions.

The Working Group has not convened since the fall of 2010. As of January 2015, the proposal has not been considered or approved for use by the SCAQMD Board. In the meantime, no GHG significance thresholds are approved for basin wide application by the Basin.

2.2.3.2 Los Angeles County Community Climate Action Plan (CCAP)

Los Angeles County is in the process of developing a Community Climate Action Plan (CCAP) to reduce GHG emissions associated with the community activities in the unincorporated Los Angeles County. The CCAP will address emissions from building energy land use and transportation, water consumption, and waste generation. The CCAP and the County's existing climate change initiatives will lay out the path to the County's sustainable future. Ultimately, the CCAP and associated GHG reduction measures will be incorporated into the Los Angeles County General Plan 2035. The Final Draft CCAP was published for public review in June 2014.

2.2.3.3 Los Angeles County Green Building Program

Three ordinances were adopted by the County of Los Angeles Board of Supervisors on October 7, 2008, and became effective January 1, 2009.[93] These ordinances include: (1) green building standards ordinance; (2) low-impact development standards ordinance; and, (3) drought-tolerant landscaping ordinance. The green building standards ordinance applies to four categories of development, with corresponding requirements for each: (1) small residential and nonresidential projects; (2) medium-sized residential projects; (3) medium-sized (i.e., 10,000 to 25,000 square feet) nonresidential, commercial, mixed-use, or first-time tenant improvement projects; and, (4) large nonresidential, commercial, mixed-use, or first-time tenant improvement projects greater than 25,000 sqft, and all new high-rise buildings greater than 75 feet in height.

In 2010, in response to the mandates set forth in the CalGreen, the Board of Supervisors adopted the Los Angeles County Green Building Standards Code (Title 31). Title 31 is currently being revised to provide clarity for the development community, ensure consistency with the State and other local agencies, and advance sustainable construction standards in the County.

2.2.3.4 Santa Clarita Valley Area Plan

The Santa Clarita Valley Area Plan (Area Plan), also called One Valley One Vision (OVOV) Plan, is a component of the Los Angeles County General Plan.[94] The most recent Area Plan, adopted in November 2012, is intended to provide focused goals, policies, and maps to guide the regulation of development within the unincorporated portions of the Santa Clarita Valley area. The Area Plan summarizes programs and actions that address climate change in the Santa Clarita Valley, including but not limited to encouraging unban infill development, adopting a mixed-use designation in the City of Santa Clarita near transit centers, increasing standards of density and floor area ratio in urban areas, including non-residential “activity areas” within urban residential areas, improving pedestrian network and bikeway systems, increasing bus service, balancing job growth with housing growth, etc.

2.2.4 Previously Adopted Plans and Mitigation

2.2.4.1 Newhall Ranch RMDP/SCP and EIS/EIR

The Project Site is included in the project area of the Project Applicant's Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan (RMDP/SCP), shown in **Figure 3-4**, RMDP/SCP Project Area, in **Section 3.0**, Project Description, of the Draft EIR, which covers certain aspects of resource management for the Project and other nearby developments. As discussed in greater detail in **Section 4.1** of the Draft EIR, Environmental and Regulatory Setting, the RMDP component is a conservation, mitigation, and permitting plan for the long-term management of sensitive biological resources and development-related infrastructure in the River and tributary drainages within the 11,999-acre Specific Plan area and along the extension of Magic Mountain Parkway through the Project Site. The SCP component is a conservation and management plan to permanently protect and

[93] Los Angeles County Department of Regional Planning. Los Angeles County Green Building Program. Available at: http://planning.lacounty.gov/green. Accessed: May 2014.

[94] Los Angeles County Department of Regional Planning. Santa Clarita Valley Area Plan. Available at: http://planning.lacounty.gov/ovov. Accessed: May 2014.

manage a system of preserves designed to maximize the long-term persistence of the San Fernando Valley spineflower (*Chorizanthe parryi ssp. Fernandina*) (spineflower), a federal candidate and state-listed endangered plant species. The SCP encompasses the Specific Plan area, the Valencia Commerce Center planning area, and the Project Site, in order to conduct conservation planning and preserve design on the Project Applicant's land holdings in Los Angeles County that contain known spineflower populations.

The Newhall Ranch RMDP/SCP project was the subject of a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (SCH No. 2000011025) by the U.S. Army Corps of Engineers (Corps) and the California Department of Fish and Wildlife (CDFW).[95,96] The EIS/EIR evaluated the existing conditions, potential impacts, alternatives, and mitigation associated with the Newhall Ranch project's GHG emissions. At the time CDFW certified the EIR portion of the EIS/EIR in December 2010, it also adopted the MMRP for the RMDP/SCP Project. This regulatory plan, required under CEQA, describes the mitigation measures, monitoring, and/or reporting plan for the Newhall Ranch project (not including the Entrada South Project Site). CDFW specifically adopted mitigation measures requiring implementation of the Project Applicant's design commitments to ensure that impacts relating to GHG emissions from implementation of the Newhall Ranch project would be less than significant (see Final EIS/EIR, Section 8.0, Global Climate Change).

2.3 Significance Thresholds

This GHG Emissions Technical Report assesses the significance of the Project's GHG emissions using five different methodologies. Further, each of the five methodologies is a separate and independent ground for the significance determination herein.

First, in accordance with State CEQA Guidelines section 15064.4(b)(1) and 15125(a), this report compares the Project's emissions with the existing GHG emissions associated with the Project site. (See also State CEQA Guidelines section 15125.)

Second, in accordance with State CEQA Guidelines section 15064.4(b)(2)-(3), this report analyzes the Project's consistency with AB 32 through evaluating the Project's GHG emissions as compared to a CARB 2020 NAT projection. This approach is consistent with the proposed SCAQMD draft GHG significance thresholds, and guidance authored by other air districts, such as the San Joaquin Valley Air Pollution Control District (SJVAPCD) and Sacramento Metropolitan Air Quality Management District (SMAQMD).[97,98]

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[95] Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan, Final Joint Environmental Impact Statement and Environmental Impact Report, June 2010.

[96] The California Department of Fish and Game was officially renamed the California Department of Fish and Wildlife as of January 1, 2013.

[97] SJVAPCD. 2011. Guidance for Valley Land-use Agencies in Addressing GHG Emission Impacts for New Projects under CEQA. Available at: http://www.valleyair.org/programs/CCAP/12-17-09/3%20CCAP%20-%20FINAL%20LU%20Guidance%20-%20Dec%2017%202009.pdf. Accessed: May 2014.

[98] SMAQMD. 2013. SMAQMD Draft GHG Thresholds of Significance Concepts, Discussion Document. Available at: http://www.airquality.org/lutran/20131113WorkshopHandout.pdf. Accessed: May 2014.

As noted above, CARB approved an update to the 2008 AB 32 Scoping Plan. This update included lower statewide growth projections and, thus, a lower reduction as compared to the CARB 2020 NAT projection that is necessary to achieve AB 32's goals. Based on current state-wide growth projections, CARB has indicated that achieving AB 32's goals would require approximately a 21.7 percent reduction as compared to the CARB 2020 NAT projection.[99,100] However, this Technical Report uses the more conservative value from CARB (i.e., 28.5 percent, rounded to 29 percent) to determine significance of the Project's GHG emissions.

Third, and again in accordance with State CEQA Guidelines section 15064.4(b)(2)-(3), this report analyzes the Project's consistency with AB 32 by comparing the Project's "modified" emissions to the SCAQMD efficiency target (4.8 MT/year CO_2e per service population) based on the Project's emissions and service population. Utilization of the District's efficiency target is not required by CEQA (or any other law) as the District's target only is in draft form; nonetheless, the target is utilized to help inform the lead agency and public of the significance of the Project's GHG emissions. Since AB 32 set the 2020 GHG reduction goal, this analysis evaluates against the 2020 SCAQMD efficiency target.

Also, the District's draft definition of "service population" leads to a negative bias for projects with high numbers of "customers" or "visitors", such as projects with non-residential uses like retail, hospitals and medical offices. With the District's draft approach, the emissions from customers and visitors are included in the total emissions, but excluded from the service population. The modified emissions inventory used in this report evaluates the emissions associated with the defined service population in order to provide for an apples-to-apples assessment; as such, customers and visitors are excluded from the emissions total and service population.

Fourth, in accordance with State CEQA Guidelines section 15064.4(b)(3), this report analyzes the Project's consistency with SB 375 by comparing the Project's land use assumptions with the SCAG 2012 SCS via reference to the number of households in SCAG's traffic analysis zones (TAZs).

Fifth, this report evaluates the Project's consistency with Executive Order S-3-05's goal of reducing GHG emissions to 80% below the 1990 level by the year 2050. Note the Legislature did not adopt the 2050 goal when enacting the 2006 Global Warming Solutions Act (AB 32) and in the last legislative session rejected legislation to enact the Executive Order's 2050 goal.[101]

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[99] CARB. 2011. Attachment D, Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. August 19. Available at: http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf. Accessed: May 2014.

[100] CARB. 2011. Status of Scoping Plan Measures. Available at: http://www.arb.ca.gov/cc/scopingplan/sp_measures_implementation_timeline.pdf. Accessed: May 2014.

[101] See *Cleveland National Forest Foundation v. San Diego Association of Governments* (2014) 231 Cal.App.4th 1056, 1096 (J. Benke, dissenting); *Professional Engineers in California Government v. Schwarzenegger* (2010) 50 Cal.4th 989, 1015; Office of Planning and Research, Guide to the California State Executive Branch (Oct. 2004), p. 8.

3 GHG Emissions Inventory

This section describes the methodology that ENVIRON International Corporation (ENVIRON) used to develop the GHG emission inventories associated with the Project, which include one-time emissions (construction emissions and emissions due to vegetation changes), and operational emissions. Sub-categories of GHG operational emissions include: **area sources, energy use**, **water supply and wastewater**, **solid waste,** and **mobile sources**. The GHG emission inventories three scenarios are estimated: the Project, Project without PDFs, and the CARB 2020 NAT scenario. Legislation and rules regarding climate change, as well as the scientific understanding of the extent to which different activities emit GHGs, continue to evolve; as such, the inventories in this report are a reflection of the guidance and knowledge currently available. As discussed above, the GHG emissions inventory for the existing conditions is described in Appendix A.

3.1 Measurement and Resources

3.1.1 Units of measurement: Tonnes of CO_2 and CO_2e

As discussed in Section 2.1, the term "GHGs" includes gases that contribute to the natural GHG effect, such as CO_2, CH_4, N_2O, and water, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as HFCs and chlorofluorocarbons (CFCs). GHG emissions are typically measured in terms of mass of CO_2e. CO_2e are calculated as the product of the mass of a given GHG and its specific GWP, as described in Section 2.1.[102] GWPs of 21 and 310 were used for CH_4 and N_2O respectively for this analysis. In many sections of this report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

In this report, a tonne refers to MT (1,000 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

3.1.2 Resources

3.1.2.1 CalEEMod®

ENVIRON primarily utilized the CalEEMod® version 2013.2.2[103] to assist in quantifying the GHG emissions in the inventories presented in this report for the Project. CalEEMod® provides a simple platform to calculate both construction emissions and operational emissions from a land use project. It calculates both the daily maximum and annual average for criteria pollutants as well as total or annual GHG emissions. The model also provides default values for water and energy use. Specifically the model aids the user in the following calculations:

[102] This report uses GWPs from the IPCC Second Assessment Report since they are used in CalEEMod®. The GWPs in the IPCC Fourth Assessment Report have been updated to 298 for N_2O and 25 for CH_4.

[103] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/. Accessed: May 2014.

One-time short term construction emissions associated with site preparation, demolition, grading, utility installation, building, coating, and paving from off-road construction equipment, and on-road mobile equipment associated with workers, vendors, and hauling.

One-time vegetation sequestration changes, such as permanent vegetation land use changes and new tree plantings.

Operational emissions associated with the fully built out land use development, such as on-road mobile vehicle traffic generated by the land uses, off-road emissions from landscaping equipment, wood stoves and hearth usage, natural gas usage in the buildings, electricity usage in the buildings, water usage by the land uses, and solid waste disposal by the land uses.

CalEEMod® is a statewide program designed to calculate both criteria and GHG emissions from development projects in California. This model was developed under the auspices of the SCAQMD and received input from other California air districts, and is currently supported by several lead agencies for use in quantifying the emissions associated with development projects undergoing environmental review. CalEEMod® utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available. These models and default estimates use sources such as the USEPA AP-42 emission factors,[104] CARB's on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD), and studies commissioned by California agencies such as the CEC and CalRecycle.

CalEEMod® is based upon CARB-approved Off-Road and On-Road Mobile-Source Emission Factor models (OFFROAD and EMFAC, respectively), and is designed to estimate construction and operational emissions for land use development projects and allows for the input of project specific information. OFFROAD[105] is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment). EMFAC[106] is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles, haul trucks). The off-road diesel emission factors used by CalEEMod® are based on the CARB OFFROAD2011 program.

In addition, CalEEMod® contains default values and existing regulation methodologies to use in each specific local air district region. Appropriate statewide default values can be utilized if regional default values are not defined. ENVIRON used default factors for Los Angeles county area (within the SCAQMD jurisdiction) for the GHG emission inventory, unless otherwise noted in the methodology descriptions below.

[104] The USEPA maintains a compilation of Air pollutant Emission Factors and process information for several air pollution source categories. The data is based on source test data, material balance studies, and engineering estimates. Available at: http://epa.gov/ttnchie1/ap42/. Accessed: May 2014.

[105] CARB. 2011. Off Road Mobile Source Emission factors. Available at: http://www.arb.ca.gov/msei/msei.htm. Accessed: May 2014.

[106] CARB. 2011. EMFAC 2011 Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: May 2014.

3.1.2.2 Other Resources

ENVIRON directly or indirectly relied on emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, energy surveys by other consulting firms, Project specific studies (e.g., Traffic study[107,108] and Domestic Water, Recycle Water and Sewer Analysis[109,110]), and emission estimation software as described above. In cases as noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above.

3.1.3 Indirect GHG Emissions from Electricity Use

The indirect GHG emissions created as a result of electricity use are based on the following methodology. Indirect emissions, such as when electricity is used in a building, are typically due to electricity generation from offsite power plant locations. For this Project, electrical power will be supplied to the Project site by Southern California Edison (SCE).

Using CalEEMod®, the electricity intensities are multiplied by the emission intensity factors for the GHGs and are classified as indirect emissions. Emission intensity factors are GHG emission rates from a given source relative to the intensity of a specific activity in term of the amount of GHG released per MW of energy produced. The default electricity intensity for SCE in CalEEMod® for CO_2, CH_4, and N_2O are 641.26, 0.029, and 0.011 pounds (lbs) per megawatt-hour (MWh), respectively. The CO_2 default factor is based on The CO_2 default factor is based on the 2007 SCE Power/Utility Protocol (PUP) report.[111] The CH_4 and N_2O default factors are based on CARB's and E-Grid values.

For this Project, the CalEEMod® CO_2 intensity factor is modified based on the 2006 and 2007 PUP reports to account for the RPS. The 2006 and 2007 PUP were both used to conservatively represent the intensity factors. The intensity factors for total energy delivered were estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO_2 emissions per total non-renewable energy metric calculated. Total energy delivery and total CO_2 emissions are provided in SCE PUP Reports. The CO_2 intensity factor presented in this analysis is consistent with the 33% RPS for 2020. The estimate provided here and the PUP reports issued by SCE show that renewable energy sources do not result in any new CO_2 emissions. CalEEMod® emission intensity factors for CH_4 and N_2O were used for this Project as a conservative estimate for these emissions.

[107] Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

[108] Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.

[109] GSI Water Solutions, Inc. 2014. Water Demand Projections for Entrada Village South. May 16.

[110] California Building Standards Commission. 2010. California Green Building Standards. Available at: http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf. Accessed: May 2014.

[111] SCE Power/Utility Protocol (PUP) Report. Available at: http://www.climateregistry.org/tools/carrot/carrot-public-reports.html. Accessed: May 2014. The 2007 report is the most recent available data. For this analysis, the 2006 and 2007 PUP reports were both used to conservatively represent

Details regarding the specific methodologies used by CalEEMod® can be found in the CalEEMod® User's Guide and associated appendices.[112] The CalEEMod® output files are provided for reference in Appendix B to this report.

3.2 One-Time Emissions

One-time emissions are those emissions that are not reoccurring over the life of the Project. This includes emissions associated with construction and emissions associated with land use changes.

3.2.1 Construction

This section describes the estimation of GHG emissions from construction activities at the Project site. While the exact construction schedule and equipment mix may vary from the current analysis, the GHG emissions are not expected to be higher than that estimated given the conservative assumptions included in this analysis. The proposed plan for constructing the Project anticipates construction to occur from 2015 to 2024. The major construction phases included in this analysis are:

Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.

Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.

Utilities Installation: involves trenching and associated activities to install vital utilities.

Building Construction: involves the construction of structures and buildings.

Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

Paving: involves the laying of concrete or asphalt such as in parking lots or roads.

There will not be a demolition phase for this development since the construction will occur on previously undeveloped land. In addition, Project grading would require the removal and recompaction of approximately 7.8 million cubic yards of existing material in a balanced cut and fill operation. Grading would include mass grading for the development areas, along with fine grading for development pads. Mass grading would consist of rough grading operations that would provide for major roads and infrastructure, including improvements outside of Vesting Tentative Tract Map (VTTM) 53295 (i.e., the External Map Improvements), establish drainage patterns, and create building pads for the various land uses within the Project Site. In addition to mass grading and fine grading, remedial grading of approximately 2.0 million cubic yards of material may also be required depending upon future site-specific soils and geotechnical investigations. Specifically, remedial grading may be required for alluvial removal and re-compaction; landslide conditions; stabilization fills; slope wash conditions (i.e., unsuitable soils that need to be removed and recompacted prior to the placement of fill materials; and lot and

[112] SCAQMD. 2013. California Emissions Estimator Model User's Guide. Version 2013.2.2. Available at: http://www.CalEEMod.com/. Accessed: May 2014.

street over-excavation in cut areas. Graded slopes would be landscaped and irrigated pursuant to County recycled water from the Valencia Water Reclamation Plant. Recycled water would be delivered to the Project grading and erosion control requirements. GHG emissions from these construction phases are largely attributable to fuel use from construction equipment and worker commuting vehicles.[113]

ENVIRON used CalEEMod® version 2013.2.2 to assist in quantification of the construction emissions. The construction schedule, off-road equipment lists and equipment specifications were Project specific estimates for all phases except for the building construction and architectural coating phases. The off-road equipment lists and equipment specifications for building construction and architectural coating phases were estimated for the Project based on CalEEMod® defaults as an estimate for the Project.[114] In addition, the daily trip counts for workers, and vendors were also based on CalEEMod® defaults taking into account the number of residential dwelling and commercial square footages to be built each year. CalEEMod® version 2013.2.2 default values were used for equipment and vehicle emission factors, equipment load factors and vehicle trip lengths. No specific mitigation measures related to GHG emissions associated with construction were assumed in this model. Use of newer model engines and higher Tier (i.e., lower emitting) off-road equipment would serve in most cases to reduce the GHG emissions. The exceptions are the use of compressed natural gas vehicles which could increase the GHG emissions from off-road vehicles slightly, and the use of diesel particulate filters, which have a small energy penalty associated with them.

ENVIRON's analysis was based on a mix of Project specific estimates and CalEEMod® defaults for the numbers and types of equipment that will be used in the construction of the Project as well as the duration of the different construction phases. The GHG calculations are intended to estimate long-term emissions. The analysis assumed that equipment operates for 6 or 8 hours a day, 5 days a week during a given phase duration. A small number of equipment was assumed to operate for 6 hours day[115], 5 days a week for site preparation, grading utility installation, and paving phases based on Project specific estimates, and 6, 7, or 8 hours a day, 5 days a week for building construction and architectural coating phases based on CalEEMod® default. The construction was assumed to start in 2015 and will be completed in 2024. The construction schedule, equipment lists, and on-road vehicle trips are shown in **Tables 2 through 4b**, respectively.

[113] In addition to the worker and vendor trips, haul truck trips were added to the site preparation to account for the truck trips hauling vegetation waste.

[114] It is noted that CalEEMod® appears to overestimate construction emissions for building construction and architectural coating for parking structures. The defaults are used in this analysis to conservatively estimate the potential emission from parking structures.

[115] Because the Project specific estimates are partial units(e.g., 0.5) for some of the equipment, the daily operating hours per equipment used in CalEEMod® was revised to conserve the total daily operating hours while keeping the equipment unit integer.

3.2.1.1 Emissions from Construction Equipment

The emission calculations associated with construction equipment are from off-road equipment engine use based on the equipment list and phase length, and on-road vehicle trips and phase length.

Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod® assumes all of the equipment operates on diesel fuel. The calculations associated with this screen include the running exhaust emissions from off-road equipment. Since the equipment is assumed to be diesel, there are no starting emissions associated with the equipment as these are de minimis for diesel-fueled equipment. CalEEMod® calculates the exhaust emissions based on CARB's OFFROAD2011 methodology using the equation presented below.[116]

$$\text{Emissions}_{\text{Diesel}} = \sum_{i} \left(EF_i \times Pop_i \times AvgHP_i \times Load_i \times Activity_i \right)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

i = equipment type

The GHG emissions associated with off-road construction equipment are shown in **Table 5**. Most of the emissions occur during the grading and building construction phases.

3.2.1.2 Emissions from On-Road Trips

Construction generates on-road vehicle GHG emissions from personal vehicles for worker and vendor commuting, and trucks for soil and material hauling. These emissions are based on the number of trips and VMT along with emission factors from EMFAC2011. As mentioned above, there will be no offsite soil hauling trucks for the Project. However, the analysis conservatively assumes that there will be 64 trips a day for hauling vegetation waste during the site preparation phase.

The emissions from mobile sources were calculated in CalEEMod® with the trip rates, trip lengths and emission factors for running from EMFAC2011 as follows:[117]

[116] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2014.

[117] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2014.

$$\text{Emissions}_{\text{pollutant}} = \text{VMT} * \text{EF}_{\text{running, pollutant}}$$

Where:

$\text{Emissions}_{\text{pollutant}}$ = emissions from vehicle running for each pollutant

VMT = vehicle miles traveled

$\text{EF}_{\text{running, pollutant}}$ = emission factor for running emissions

Starting and idling emissions were also calculated in CalEEMod® by multiplying the number of trips by the respective emission factor for each pollutant. The GHG emission from on-road vehicles associated with construction is shown in **Table 6**. Most of the emissions were generated from the vendor trips. Note that up-to six on-road vehicles that will be used on-site to transport construction supervisors in each phase were modeled in CalEEMod® as off-site on-road vehicles to more accurately represent the emissions associated with these vehicles.

3.2.1.3 Total Construction Emissions

The total emissions from construction are summarized in **Table 7**. Because there are no project design features that would reduce the construction GHG emissions, the Project, Project without PDFs, and CARB 2020 NAT scenarios will yield the same emissions. Total GHG emissions from all project phases for off-road and on-road emissions are 5,128 and 4,395 $MTCO_2e$, respectively. Total GHG emissions from the construction activities are 9,523 $MTCO_2e$.[118] When amortized over 30-year project lifetime, the construction GHG emissions are 317 $MTCO_2e$/year.[119] Detailed emission inventory from the CalEEMod® output files are included in Appendix B.

3.2.2 Vegetation Changes

This section presents the calculation of the positive and negative GHG emissions associated with vegetation removal and re-vegetation at the Entrada South development. Permanent vegetation changes that occur as a result of project development constitute a one-time change in the carbon sequestration capacity of a project site. In this case, undeveloped land will be converted to different land uses with landscaped areas with trees. This will result in an overall net loss of carbon sequestration once the vegetation reaches a steady state (i.e., new vegetation replaces dying vegetation). Consequently, vegetation change results in a GHG emissions increase.

CalEEMod® was used to calculate GHG emissions associated with the vegetation activities of land use change and the planting of new trees, as according to the IPCC protocol for vegetation. Overall Change in Sequestered CO_2e can be estimated with this equation: [120]

[118] The up-to six onsite on-road vehicle emissions are included as on-road emissions.

[119] This approach to one-time construction and vegetation change GHG emissions is based on the GHG Threshold Working Group Meeting #13 Minutes from August 26, 2009. Available at: http://sfprod.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-13/ghg-meeting-13-minutes.pdf?sfvrsn=2. Accessed: May 2014.

[120] SCAQMD. 2013. California Emissions Estimator Model User's Guide, Appendix A. Available at:

$$\text{Overall Change in Sequestered } CO_2 = \sum_i \left((SeqCO_2)_i \times area_i \right) - \sum_j \left((SeqCO_2)_j \times area_j \right)$$

Where:

$SeqCO_2$ = mass of sequestered CO_2 per unit area [MT CO_2e/acre]

area = area of land for specific land use type [acre]

i = index for final land use type

j = index for initial land use type

There is no reduction in GHG emissions associated with preservation of a land. The vegetation changes result in net loss of carbon sequestration. The detail as to the addition of 4,000 net new trees is shown in **Table 8**.

3.2.2.1 Vegetation Change Emissions

The change in vegetation at the proposed Project site results in a one-time net release of carbon as shown in **Table 9** for both Project and Project without PDFs scenarios, and the CARB 2020 NAT scenario. Because there are no project design features that would reduce the net release of GHG emissions, the Project, Project without PDFs, and CARB 2020 NAT scenarios will yield the same emissions. The Project site CO_2e sequestered emissions were estimated to be 4,114, but the net new trees will sequester 2,837 $MTCO_2$e. In other words, the Project is estimated to release a total of 1,278 $MTCO_2$e or 43 $MTCO_2$e per year if amortized over a 30-year project lifetime.

3.3 Annual Operational Emissions

Emissions from area sources and indirect emissions from energy and water use, wastewater, as well as waste management, and mobile sources would occur every year after build out. This section outlines the operational GHG emissions.

3.3.1 Area Sources

Area sources in CalEEMod® are direct sources of GHG emissions. The area source GHG emissions included in this analysis result from landscaping-related fuel combustion sources, such as lawn mowers, and from natural gas fireplaces.[121] GHG emissions due to natural gas combustion in buildings other than from fireplaces are excluded from this section since they are included in the emissions associated with building energy use.

GHG emissions associated with natural gas fired fireplaces are calculated using CalEEMod®, which in turn uses emission factors from the CCAR. The average heating rate in British Thermal Units (BTU) per hour for fireplaces in homes is 60,000 BTU/hour. Natural gas is assumed to have 1,020 BTU per standard cubic foot.

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http://www.CalEEMod.com/. Accessed: May 2014.

[121] Wood-burning fireplaces and stoves are largely prohibited in the South Coast Air District as of March 9, 2009. Rule 445.

The GHG emissions for the Project were calculated using CalEEMod® defaults based upon the land uses that will be part of these developments, except as noted below:

All cooking stoves and fireplaces were assumed to be natural gas burning, based on SCAQMD Rule 445;

Only 80% of the residential dwelling units will contain fireplaces as a project design features.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

Both the 2020 Project without PDFs scenario and the CARB 2020 NAT scenario assume that the CalEEMod® default percentage of dwelling units (90 percent) will contain fireplaces.

Estimated Emissions by Scenario

The resulting GHG emissions for Project and Project without PDFs scenarios are shown in **Table 10**, and the resulting GHG emissions for the CARB 2020 NAT scenario are shown in **Table 11**.

The Project GHG emissions from area sources are estimated to be 331 $MTCO_2e$/year while the GHG emissions for the CARB 2020 NAT scenario and Project without PDFs scenario are 369 $MTCO_2e$/year, reflecting 38 $MTCO_2e$/year of additional emissions over the Project scenario because of a greater percentage of dwelling units containing fireplaces. The reductions from the Project comprise GHG emission reductions of 10.3 percent from the total CARB 2020 NAT scenario for this category of emissions.

3.3.2 Energy Use

GHGs are emitted from buildings as a result of activities for which electricity and natural gas are typically used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; these emissions are considered direct emissions associated with a building. GHGs are also emitted during the generation of electricity from fossil fuels; these emissions are considered to be indirect emissions. **Table 12** lists the emission factors for electricity used in this analysis and how it was calculated. Climate Zone 9 was selected based on the CEC forecast climate zone map shown in the CalEEMod® User's Guide. Project emissions have been calculated using a SCE emission factor that accounts for the 33 percent RPS required by 2020, as discussed in Section 3.3. The adjusted SCE emission factor is based on the 2006 and 2007 PUP reports, which reports the mix renewable and non-renewable sources in SCE's energy supply. With this data, the SCE emission factor is adjusted to represent what the emissions from SCE would be in 2020.

3.3.2.1 Solar Panels

A solar panel is a set of solar PV modules electrically connected and mounted on a supporting structure to provide additional electricity. Solar panels are assumed to be installed both on the roof of single family homes (SFH) and on commercial roof for this Project based on the project design feature.

Total Project electricity supplied by PV module was calculated based on the Project commitment to use the renewable energy equivalent to including a 2-kW solar panel for every SFH dwelling unit, and for every 1,600 sqft of commercial office and retail effective roof area.

The number of panel systems was calculated based on the number of single family residences and the estimated available commercial roof area divided by 1,600. As a conservative estimate, the calculation assumes that available roof area is 50 percent of the commercial office and retail building area. The number of operation hours for the solar panels was estimated to be 4.6 hours per day. The associated reduction GHG emissions due to the reduction in electricity required from SCE is based on the SCE emission factor that accounts for the 33% RPS required by 2020, as discussed in Section 3.3. Based on the assumptions for this analysis, a 2-kW system is estimated to fulfill approximately 50 percent of the electricity demand of a SFH.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The CARB 2020 NAT and Project without PDFs scenarios assume that no solar panels are installed to provide renewable energy equivalent to the commitment discussed above. The CARB 2020 NAT scenario also does not account for the 33 percent RPS.

Estimated Emissions by Scenario

Detailed calculations for the emission reductions from the solar panel usage are shown in **Table 13** for both residential and commercial land uses. Annual GHG reductions as a result of solar panel usage for the Project or equivalent measures were estimated to be 435.67 $MTCO_2e$/year compared to the CARB 2020 NAT and Project without PDFs scenarios. The reductions from the Project account for GHG emission reductions of 5.0 percent from the total CARB 2020 NAT scenario for this category of emissions.

3.3.2.2 Solar Heated Pools

The emissions associated with heating of public pools are included in the emissions inventories. The calculation assumes that the Project will have one solar heated 25 meter (m) x 25 m pool. The electricity and natural gas usage per gallon of swimming water was derived from a survey of five pools in Oakland, California as shown in **Table 14a**.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The Project without PDFs scenario and the CARB 2020 NAT scenario assume that there would be natural gas heating.

Estimated Emissions by Scenario

The total annual CO_2e emissions for the Project scenario are 45.67 MT/year as shown in **Table 14b**. The total annual emissions for the CARB 2020 NAT scenario are 356.82 MT/year. The Project is estimated to have an 87.2 percent reduction of GHG emissions as compared to the CARB 2020 NAT scenario for this category of emissions. The total annual CO_2e emissions for the Project without PDFs scenario are 345.14 MT per year as shown in **Table 14b**. This reflects 299.47 $MTCO_2e$/year of additional emissions over the Project scenario because the Project includes the installation of solar water heaters while the Project without PDFs scenario assumes natural gas heating.

3.3.2.3 Emissions Estimation from Energy Use

Energy use in buildings is divided into energy consumed by the built environment and energy consumed by uses that are independent of the construction of the building such as in plug-in

appliances. In California, Title 24 governs energy consumed by the built environment, mechanical systems, and some types of fixed lighting.[122] Non-building energy use, or "plug-in" energy use can be further subdivided by specific end-use (refrigeration, cooking, office equipment, etc.).

CalEEMod® was used to calculate the residential and non-residential energy use by calculating energy usage from systems covered by Title 24. As mentioned in section 2.2.2.3, because CalEEMod® employs energy usage data reported in the RASS and CEUS, both of the 2006 and 2013 Appliance Efficiency Regulations were not included in the analysis. If these two regulations were incorporated into the analysis, it is likely that the Project energy use would be lower than that estimated here. And thus, the reduction from the CARB 2020 NAT scenario would be greater than that currently estimated.

To calculate the building energy input for the Project (e.g., electricity, and natural gas), ENVIRON utilized default values provided in CalEEMod®, which are based on the CEUS and RASS[123] and correspond to 2008 Title 24. The 2013 Title 24 is anticipated to be 25 percent more efficient than the 2008 Title 24 for residential construction and 30 percent better for nonresidential construction.[124] Since CalEEMod® is based on the 2008 Title 24, these percentage reductions were applied to the relevant CalEEMod® default energy intensity factors to estimate the energy demand for the Project.

CalEEMod® converts the resulting energy use quantities to GHG emissions by multiplying by the appropriate emission factors obtained by incorporating information on local electricity production. Unless otherwise noted, CalEEMod® default parameters were used.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The CARB 2020 NAT scenario assumes 2005 Title 24 standards to estimate the energy intensity values, no commitments to solar on commercial land use and SFH, and default emission factors for each utility for the local electricity production.

The Project without PDFs scenario assumes 2013 Title 24 standards to estimate the energy intensity values, no commitments to solar on commercial land use and SFHs, and emission factors incorporating 33 percent RPS for the local electricity production.

Estimated Emissions by Scenario

For the Project scenario, CO_2e emissions from electricity and natural gas usages were estimated to be 4,273 and 1,440 $MTCO_2e$/year, respectively, or 5,713 $MTCO_2e$/year total, as shown in **Table 15**. The CARB 2020 NAT scenario is estimated to emit 6,491 and 2,264 $MTCO_2e$/year from electricity and natural gas usage, respectively, or 8,755 $MTCO_2e$/year total

[122] Title 24, Part 6, of the California Code of Regulations: California's Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/. Accessed: May 2014

[123] A detailed explanation how the RASS and CEUS data was processed for use in CalEEMod® is available in CalEEMod® User's Guide Appendix E.

[124] Information Available at: http://www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html. Accessed: May 2014.

(**Table 16**). The total emissions from energy use are 5,713 and 8,755 $MTCO_2e$/year for the Project and its CARB 2020 NAT scenario. The Project is estimated to have a 34.75 percent reduction of GHG emissions as compared to the CARB 2020 NAT scenario for this category of emissions.

For the Project without PDFs scenario, CO_2e emissions from energy and natural gas usages were estimated to be 4,708 and 1,740 $MTCO_2e$/year, respectively, or 6,448 $MTCO_2e$/year total, as shown in **Table 15**. This reflects 735 MT CO_2e per year of additional emissions over the Project scenario because the Project includes solar PV modules or equivalent offsets and the solar heated pool as discussed above.

3.3.3 Water Supply, Treatment and Distribution

Indirect GHG emissions result from the production of electricity used to convey, treat and distribute water and wastewater. The amount of electricity required to convey, treat and distribute water depends on the volume of water as well as the sources of the water. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater. Water demand, recycled water usage, and waste water generation values were extracted from the Project Water Demand Report (see Appendix C).

The water demand listed in the Water Demand Report was used as the basis for the estimate of GHG emission associated with water supply, treatment and distribution for the Project. The Project will also comply with the CalGreen Standards, which will require a 20 percent reduction of indoor potable water use through the use of water saving fixtures and or flow restrictors.[125] As a conservative estimate, the indoor water usage from the Water Demand Report was assumed to be the Project water usage. The Project water usage also assumes that recycled water will be used to satisfy a portion of its demand for outdoor, irrigation-related water. ENVIRON used CalEEMod® default assumptions for average embodied energy[126] for Southern California, which are based on a study commissioned by the CEC[127]. This study published recommended electricity intensities for the supply and conveyance, treatment and distribution of water, as well as treatment of wastewater, for Northern and Southern California. As discussed above, these factors account for the energy embodied in water use. The CalEEMod® default embodied energy for the transportation of the waste water for the Project is a conservative estimate since the water reclamation plant will be within the NRSP area, and not outside the Project as assumed by the default electricity intensity factor for wastewater treatment.

CalEEMod® contains an error when regarding the energy savings of using recycled water. The error leads to a conservatively higher estimate of the energy required for the use of recycled water. Correcting this error would result in lower emissions related to water use for the Project.

[125] CSBC. 2010. 2010 California Green Building Standards. 4.303.1. Available at: http://www.documents.dgs.ca.gov/bsc/calgreen/2010_ca_green_bldg.pdf. Accessed: May 2014.

[126] Embodied energy refers to the amount of energy that was used in delivering water to the specific land use.

[127] CEC. 2006.Refining Estimates of Water-Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF. Accessed: July 2014.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The CARB 2020 NAT scenario assumed water usage without accounting for the 20 percent reduction resulting from the CalGreen mandated water saving measures, and without the use of the recycled water. GHG emissions related to the water and wastewater conveyance were based on the utility emission factors consistent with the CARB 2020 NAT scenario (i.e., assuming that the 33 percent RPS requirement did not exist). All other assumptions regarding wastewater treatment were assumed to be the same as the Project.

All the assumptions for the Project without PDFs scenario are the same as that for the Project scenario.

Estimated Emissions by Scenario

The Project was estimated to have 155 and 202 thousand gallons (Mgal) per year of indoor and outdoor water usages and was estimated to result in 1,167 $MTCO_2e$/year as shown in **Table 17**. The associated CARB 2020 NAT scenario was estimated to have 186 and 218 Mgal/year of indoor and outdoor water usages and was estimated to result in 1,620 $MTCO_2e$/year as shown in **Table 18**. The Project is estimated to have a 27.94 percent reduction of GHG emissions as compared to the CARB 2020 NAT scenario.

The Project without PDFs scenario was estimated to have the same indoor and outdoor water usage as the Project as shown in **Table 17**. This results in the same emissions as the Project scenario.

3.3.4 Solid Waste

Municipal solid waste (MSW) is the amount of material that is disposed of by land filling, recycling, or composting. CalEEMod® calculates the indirect GHG emissions associated with waste that is disposed of at a landfill using waste disposal rates by land use and overall composition.

The emission estimates in this Project were based on City of Santa Clarita 2012 actual disposal rate.[128] CalEEMod® uses the overall California Waste Stream composition to generate the necessary types of different waste disposed into landfills. The program quantifies the GHG emissions associated with the decomposition of the waste which generates methane based on the total amount of degradable organic carbon. The program quantifies the CO_2 emissions associated with the combustion of methane, if applicable. Default landfill gas concentrations were used as reported in Section 2.4 of AP-42. The IPCC has a similar method to calculate GHG emissions from MSW in its 2006 Guidelines for National Greenhouse Gas Inventories.

The analysis assumes that an additional waste will be diverted from landfills by a variety of means, such as reducing the amount of waste generated, recycling, and/or composting to meet the statewide goal of 75 percent waste diversion.[129] The remainder of the waste not diverted will

[128] CalRecycle. Available at: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversionPost2006.aspx. Accessed: May 2014.

[129] CalRecycle. 2013. California's 75 Percent Initiative. Available at: http://www.calrecycle.ca.gov/75percent/. Accessed: May 2014.

be disposed of at a landfill. GHG emissions from landfills are associated with the anaerobic breakdown of material. The CalEEMod® version 2013.2.2 solid waste module determines the GHG emissions associated with the disposal of solid waste into landfills, in quantities that are based upon land use type according to waste disposal studies conducted by CalRecycle. For this module, CalEEMod® version 2013.2.2 used City of Santa Clarita actual disposal rate.[130] GHG emissions associated with non-landfill diverted waste streams are not considered, because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions when operated effectively.[131] These waste diversion alternatives may result in differences in life-cycle emissions of GHGs, but it is not appropriate to combine life-cycle emissions for only one category of emissions.[132] As mentioned previously, biogenic CO_2 emissions were not included when CARB analyzed the GHG emissions inventory under AB 32. Therefore, they are not included in the Project emissions inventory.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The CARB 2020 NAT scenario assumes a solid waste diversion from the landfills consistent with what was occurring prior to the passing of AB 32. Conservatively, this was assumed as 50 percent,[133] the waste diversion rate reported for the year 2006. The Project without PDFs scenario assumes the same solid waste diversion of 75 percent, as assumed for the Project.

Estimated Emissions by Scenario

The Project was estimated to generate 3,957 tons/year of solid waste and was estimated to result in 1,800 $MTCO_2e$/year as shown in **Table 19** for both Project and Project without PDFs scenarios. The associated CARB 2020 NAT scenario was estimated to generate 7,914 tons/year of solid waste and was estimated to result in 3,600 $MTCO_2e$/year as shown in **Table 20**. The Project estimated to have a 50.00 percent reduction of GHG emissions as compared to the CARB 2020 NAT scenario for this category of emissions.

3.3.5 Mobile Source Emissions

The GHG emissions associated with on-road mobile sources are generated from residents, workers, customers, and delivery vehicles visiting the land use types in the project. The GHG emissions associated with on-road mobile sources includes running and starting exhaust emissions. Running emissions are dependent on VMT. Starting emissions are associated with the number of starts or time between vehicle uses and the assumptions used in determining these values are described below. ENVIRON estimated mobile source emissions using the trip rates specified in the Traffic Study[134], trip reduction consistent with the CAPCOA guidance[135]

[130] Actual disposal rates are equivalent to a 50% diversion rate based on jurisdiction-specific average of per capita generation rates for years 2003 to 2006. Therefore the actual disposal rates were divided by 50% to obtain the disposal rate without any diversion.

[131] CARB. 2010. Local Government Operations Protocol. Chapter 9.4.

[132] This inventory represents scope 1 and 2 emission categories. A life-cycle analysis of waste diversion would be a scope 3 inventory. CARB's Local Government Operations Protocol Version 1.1 (May 2010) clearly states that scope 3 emissions should not be combined with scope 1 and 2 emissions.

[133] CalRecycle. 2006. Santa Clarita Jurisdiction Diversion / Disposal Rate Detail, Available at: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversionPost2006.aspx Accessed: May 2014.

[134] Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

(see Appendix D), trip length from the Santa Clarita Valley Area Plan (also called the OVOV Plan),[136] and CalEEMod®. These components are discussed below.

The analysis includes the benefit of reductions from some adopted regulatory programs such as Pavley, LCFS and Advanced Clean Cars, which are accounted for as follows.

AB 1493 ("the Pavley Standard") requires CARB to adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light-duty trucks of model year 2009 and thereafter. The CalEEMod® model includes emission reductions for non-commercial passenger vehicles and light-duty trucks of model year 2017 – 2025.

The LCFS went into effect on April 15, 2010, and requires a reduction in the carbon intensity of transportation fuels used in California by at least 10 percent by 2020. Reductions due to LCFS were further applied to CO_2 emission factors after adjustments from Pavley I for scenario years 2011 and after. This is also included in the CalEEMod® model.

The ACCs program, introduced in 2012, combines the control of smog, soot causing pollutants and greenhouse gas emissions into a single coordinated package of requirements for model years 2015 through 2025. This regulation has not been incorporated into CalEEMod®, and thus an estimate of the GHG emission factor reductions from the ACCs program were separately incorporated into the analysis. The emission factors were adjusted for the Advanced Clean Cars regulation based on the CARB's LEV III database model (LEV3 Tool), which was used to estimate the statewide Advanced Clean Cars emissions reduction factors for 2020.[137] The ACCs emission reduction factors were incorporated into the analysis by multiplying the CalEEMod® emission factors by the Advanced Clean Cars emission reduction factors for the Project emissions inventory.

There are other regulations that may also further reduce mobile source related emissions such as the USEPA/NHTSA advanced fuel economy and GHG standards for medium and heavy duty trucks for model years 2014-2018. The analysis does not incorporate the potential emission reductions from the USEPA/NHTSA advanced fuel economy and GHG standards for medium and heavy duty trucks. Excluding these reductions results in a more conservative (i.e., higher) Project emissions inventory given the likely decreases in GHG emissions associated with the USEPA/NHTSA standards.

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

Consistent with the AB 32 Scoping Plan, the CARB 2020 NAT scenario assumes that the Pavley, LCFS regulations, and ACC Program are not in place. The Project without PDFs scenario, however, assumes these programs are in place.

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[135] Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.

[136] Los Angeles County Department of Regional Planning. Santa Clarita Valley Area Plan. Available at: http://planning.lacounty.gov/ovov. Accessed: May 2014.

[137] Available at: http://www.arb.ca.gov/msei/categories.htm#onroad_motor_vehicles . Accessed: May 2014.

3.3.5.1 Trip Type

As discussed in the Project's Traffic Study, future year traffic forecasts are derived using the Santa Clarita Valley Consolidated Traffic Model (SCVCTM) taking into account the five trip types as described below:

H-W: Home-based worker trips

H-S: Home-based shopping trips

H-O: Home-based "other" (i.e., non-work, non-shopping) trips

O-W: Other-based work trips

O-O: Other-based other trips

Each trip type has unique characteristics, which are reflected in the model. All trips that are generated within the model limits are first categorized into one of the five trip types. The model then calculates the distribution of each traffic analysis zone based on the trip type. The final step of the trip distribution process aggregates all the trips together into a single trip table matrix that includes all five trip types. Since the GHG emissions ultimately depend on the total VMT, the Project analysis used the aggregated trip rate provided in the Project Traffic Study. Additional description regarding the trip types evaluated for the Project is included in Appendix E.

3.3.5.2 Trip Length

As discussed in the Project's Traffic Study, the trip length was developed consistent with the trip distribution process described above. The appropriate trip length characteristics of the various types of trip are reflected in the traffic forecasting process with the SCVCTM. The SCVCTM has been utilized in a number of prior transportation planning studies for the Santa Clarita Valley, such as the Santa Clarita Valley Area Plan/City General Plan update (also called the OVOV Plan).[138] That study effort produced average trip length estimates for various land use and transportation network scenarios. The OVOV plan adopted by the County and City estimates an average trip length of 11.6 miles. [139] This average trip length represents an aggregated trip length of the five trip types discussed above and was used in this analysis for all external trips. External trips are those that may begin or end outside of the Project site. Note that some of the external trips are expected to originate and end within the Westside Area (as defined to include Mission Village, Homestead South, Entrada North, Landmark Village, Legacy Village, Potrero Village, Homestead North and Valencia Commerce Center). External trips beginning or ending

[138] Los Angeles County Department of Regional Planning. Santa Clarita Valley Area Plan. Available at: http://planning.lacounty.gov/ovov. Accessed: May 2014.

[139] As discussed in the main text, the County's and City's OVOV plan assumes that the average trip length for the Project area is 11.6 miles; and, the analysis conducted here utilizes that trip length assumption for all external trips associated with the Project. Note that, prior to the adoption of the OVOV plan, the SCVCTM identified 16.6 as the average home-work trip length outside of the Project area and 10.7 miles as the average home-work trip length within the Project area. (See RMDP/SCP Final EIS/EIR (November 2010; SCH No. 2000011025), pages RTC-F02-42 – RTC-F02-43.) Accordingly, in comparison to other portions of the Santa Clarita Valley, the trip length reduction benefits of the Applicant's Westside Project Area development plans, which provide for the creation of planned communities that integrate job-creating and community-serving uses in an interconnected geographic area, have long been recognized in the traffic model used in the Santa Clarita Valley. (See Appendix F of this technical report for a definition of what constitutes the geographic area associated with the Westside Project Area.)

in the Westside Area would have a shorter average trip length than the average trip length of 11.6 miles. The current analysis conservatively does not include this shorter average trip length for trips beginning or ending in the Westside Area.

The analysis also incorporates an estimate for internal trip lengths (i.e., trips that originate and end within the Project boundaries). An internal trip length of one mile was estimated based on the average distance between residential and commercial locations within the Project site. The overall trip length was estimated using a weighted average trip length of the external and internal trip lengths. The weighting factor was the average daily trips estimated in the Project Traffic Study for external and internal trips. Since CalEEMod® generally relies upon trips (not trip ends) as the basis for inputs to estimate traffic related emissions, the trip end data in the Project Traffic Study were converted to trips in order to develop the CalEEMod® model inputs consistent with the information in the Project Traffic Study. This conversion was performed by dividing the internal trip ends by two, to estimate the number of internal trips because each internal trip has two trip ends. The results of this analysis are shown in **Table 21**. The same assumptions are included for the CARB 2020 NAT scenario.

3.3.5.3 Trip Reductions

The Project will reduce the estimated trip generation based on its implementation of the traffic-related design elements and project design features, collectively referred to as Transportation Demand Management (TDM) measures. The impact of the Project trip reduction estimates from the TDM measures are shown in **Table 22**. The percent reductions are taken from an evaluation consistent with the CAPCOA guidance[140] (see Appendix D).

Assumptions for Project without PDFs and CARB 2020 NAT Scenario

The CARB 2020 NAT scenarios assumes that the TDM measures described above are not included since these are design elements and project design features which have been specifically incorporated to help reduce trip generation. The telecommuting reduction, however, is incorporated into the CARB 2020 NAT scenario consistent with the definition of the CARB 2020 NAT scenario. The trip reduction estimates for the CARB 2020 NAT scenario due to telecommuting are shown in **Table 23**. The Project without PDFs scenario assumes that all the TDM measures described above, including telecommuting are not in place.

3.3.5.4 Pass-by and Diverted Trips

Trip link types further describe the characteristics of the trip attracted to each land use, whether it is a primary trip, a diverted link trip, or a pass-by trip. For example, a commercial customer pass-by trip could be a person going from home to shop on his/her way to work. In addition, a commercial customer diverted-link trip could be a person going from home to work, and on its way making a diversion to shop. Pass-by trips generate virtually no additional running emissions but could generate additional resting and startup emissions. Diverted trips generate less running emissions compared to primary trips, and can also generate additional resting and startup emissions.

[140] Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.

The trip distribution and trip assignment processes utilized in SCVCTM estimates primary trip, pass-by trips, and diverted trips. When utilizing traffic forecasts produced by the SCVCTM, it is unnecessary to undertake additional steps to estimate the number of diverted trips or pass-by trips since they are reflected in the total trip forecasts produced by the model.

As a result, this analysis assumes that all trips are “primary” trips. The CalEEMod® input assumptions for the mobile source emission estimates are shown in **Tables 24 and 25** for the Project and the CARB 2020 NAT scenarios, respectively.

3.3.5.5 Estimated Emissions from Mobile Sources

The Project was estimated to generate approximately 100,721,105 VMT/year and was estimated to result in 39,641 $MTCO_2e$/year as shown in **Table 26**. The associated CARB 2020 NAT scenario is estimated to generate approximately 110,280,782 VMT/year and was estimated to result in 57,196 $MTCO_2e$/year as shown in **Table 27**. The Project is estimated to have a 30.69% reduction of GHG emissions as compared to the CARB 2020 NAT scenario for this category of emissions.

The Project without PDFs scenario was estimated to generate approximately 110,519,000 VMT/year and to result in 43,497 $MTCO_2e$/year as shown in **Table 26**. The emissions of the Project without PDFs scenario represent the Project’s emissions when the TDM measures are not incorporated but all other assumptions remain the same as the Project emissions inventory described above. Note that the Project without PDFs scenario has a larger VMT but smaller emissions compared to the CARB 2020 NAT scenario because its emission factor incorporates the Pavley, LCFS regulations, and ACC Program.

4 Inventory in Context

This section assesses the significance of the Project's emissions for purposes of CEQA.

4.1 Existing Conditions Analysis

In accordance with State CEQA Guidelines section 15064.4(b)(1) and 15125(a), this report considers the "extent to which the [P]roject may increase or reduce [GHG] emissions as compared to the existing environmental setting". As previously documented, the Project site – in its existing condition – emits approximately 13.2 MT of CO_2e per year, and the Project emits approximately 49,012 MT CO_2e per year (see **Tables ES-1** and **ES-2**). While the Project results in an obvious change to the existing environment, by increasing existing GHG emission levels by approximately 48,999 MT of CO_2e per year, there is no scientific or regulatory consensus regarding what particular quantity of GHG emissions is significant. Further, no agency with regulatory authority and expertise, such as the CARB or SCAQMD, has adopted numeric GHG thresholds for land use development projects for purposes of CEQA. Indeed, while global climate change is widely viewed as a cumulative problem warranting international treatment and regulation, no authoritative regulatory body has yet devised a numeric significance emissions cap that can be applied at the project level. Therefore, this numeric delta is not a meaningful, informative or reliable indicator of the significance of the Project's GHG emissions.

4.2 AB 32 Analysis – Scoping Plan's Business-As-Usual Projections

In accordance with State CEQA Guidelines section 15064.4(b)(2)-(3), this report considers (i) whether the Project's emissions "exceed a threshold of significance that the lead agency determines applies" and (ii) "the extent to which the [P]roject complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of [GHG] emissions". In assessing the Project's significance under these two criteria, reference is made to the California Global Warming Solutions Act of 2006, also known as AB 32. AB 32 requires the State to achieve 1990 levels of GHG emissions by 2020, which numerically equates to a 28.5 percent reduction in GHG emissions.

In order to assess the Project's significance under AB 32, the report compares the proposed Project's emissions to the Project's emissions if the Project were built using a BAU or NAT approach in terms of design, methodology, and technology. Stated a bit differently, this report compares the Project's GHG emissions to the emissions that would occur from a development without the project design feature commitments made by the Project and without the regulatory requirements that have been promulgated to comply with AB 32. (A summary of the CARB 2020 NAT and Project scenario assumptions are included in **Table 28**.) This methodology is based on the CARB's Scoping Plan, which was adopted pursuant to AB 32 and found that statewide GHG emission levels need to be reduced by 28.5 percent in order for the State to achieve the mandate of AB 32. If the proposed Project results in 29 percent fewer GHG emissions than the CARB 2020 NAT scenario, impacts are less than significant.

The emissions for the Project and the CARB 2020 NAT scenario are estimated to be approximately 49,012 and 71,901 MT CO_2e per year, respectively, which results in a Project emission reduction of 31.83 percent from the CARB 2020 NAT scenario (see **Table ES-3**). As such, the Project will not result in significant impacts under this methodology.

4.3 AB 32 Analysis – SCAQMD Draft Efficiency Target

In order to assess the Project's significance under AB 32, the report also compares the Project's "modified" emissions to the SCAQMD or District draft efficiency target for 2020. The District's draft 2020 target for project-level analysis is 4.8 MT/year CO_2e per service population (land use employment only). The Project's efficiency metric is estimated to be 4.67 MT/year CO_2e per service population, such that the Project will not result in significant impacts under this methodology, as well (see **Table ES-5**).

4.4 SB 375 Analysis

In accordance with State CEQA Guidelines section 15064.4(b)(3), this report considers "the extent to which the [P]roject complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of [GHG] emissions". In assessing the Project's significance under this criterion, reference is made to the Sustainable Communities and Climate Protection Act of 2008, also known as SB 375. SB 375 requires the State's metropolitan planning organizations to adopt a "sustainable communities strategy," or an SCS, that coordinates transportation and land use planning in order to reduce GHG emissions from light duty, passenger vehicles.

In order to assess the Project's significance under SB 375, the consistency of the Project's land use assumptions with the Southern California Association of Governments' (SCAG 2012 SCS was evaluated by reference to the number of households in SCAG's TAZs. (See Appendix F.) Based on that evaluation, the Project is consistent with SCAG's SCS and will not impair the region's ability to achieve the GHG reductions from light duty vehicles required by SB 375 because the land use development pattern proposed by the Project is consistent with SCAG's SCS growth patterns.

4.5 Post-2020 Reduction Targets

This Technical Report also evaluates the Project's consistency with Executive Order No. S-3-05's goal of reducing the State's GHG emissions to 80 percent below the 1990 level by the year 2050.

In June 2005, former Governor Schwarzenegger signed Executive Order No. S-3-05, which established the following GHG emission reduction targets for California: (1) by 2010, reduce GHG emissions to 2000 levels; (2) by 2020, reduce GHG emissions to 1990 levels; and, (3) by 2050, reduce GHG emissions to 80 percent below 1990 levels. However, in adopting the 2006 Global Warming Solutions Act (AB 32), the Legislature did not adopt the 2050 horizon-year goal from the Executive Order; and, in the last legislative session, the Legislature rejected legislation to enact the Executive Order's 2050 goal.[141]

As of 2004, California was emitting 12 percent more GHG emissions than in 1990.[142] For California to emit 80 percent less than it emitted in 1990, the emissions would be only 18 percent of the 2004 emissions. Accounting for a population growth from 35,840,000 people in 2004 to approximately 55,000,000 people in 2050, the emissions per capita would have to be only 12 percent of what they were in 2004. This means 88 percent reductions in per capita GHG emissions from today's emissions intensities must be realized in order to achieve California's 2050 GHG goals. Clearly, energy efficiency and reduced vehicle miles traveled will play important roles in achieving this aggressive goal, but the decarbonization of fuel will also be necessary.

The extent to which GHG emissions from traffic at the Project will change in the future depends on the quantity (e.g. number of vehicles, average daily mileage) and quality (i.e. carbon content) of fuel that will be available and required to meet both regulatory standards and residents' needs. In addition, renewable power requirements, low carbon fuel standards, and vehicle emissions standards discussed above will all decrease GHG emissions per unit of energy delivered or per vehicle mile traveled. Due to the technological shifts required and the unknown parameters of the regulatory framework in 2050, quantitatively analyzing a Project's impacts further relative to the 2050 target are speculative for purposes of CEQA.

That being said, studies[143] have shown that, in order to meet the 2050 target, aggressive technologies in the transportation and energy sectors, such as electrification and maturation of technologies still in development (e.g., advanced batteries and more efficient biofuels), will be required. One recent study[144] indicated that, even with these emerging technologies, the 2050

[141] See Cleveland National Forest Foundation v. San Diego Association of Governments (2014) 231 Cal.App.4th 1056, 1096; Professional Engineers in California Government v. Schwarzenegger (2010) 50 Cal.4th 989, 1015; and see Office of Planning and Research, Guide to the California State Executive Branch (Oct. 2004), p. 8.

[142] CEC. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. October. Available at: http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-D.PDF. Accessed: May 2014.

[143] Lawrence Berkeley National Laboratory (LBL). 2011. California's Energy Future – The View to 2050. May. Available at: http://ccst.us/publications/2011/2011energy.php. Accessed: July 2014.

[144] LBL. 2013. Estimating Policy-Driven Greenhouse Gas Emissions Trajectories in California: The California Greenhouse Gas Inventory Spreadsheet (GHGIS) Model. Available at: http://eetd.lbl.gov/publications/estimating-policy-driven-greenhouse-g. Accessed: July 2014.

goal will not be met, due to the population growth to 55 million by 2050. A more recent study[145], however, shows that the existing and proposed regulatory framework will allow the State to reduce GHG emissions to 40 percent below 1990 levels by 2030, and to 60 percent below 1990 by 2050. Even though this study did not provide a regulatory and technology roadmap to achieve the 2050 target, it demonstrated that various combinations of policies could allow Statewide emissions to remain very low through 2050, suggesting that the combination of new technologies and other regulations not analyzed in the study could allow the State to meet the 2050 target.

While it would be speculative to quantitatively estimate the Project's emissions level in 2050 and to assess the impacts to the Executive Order's horizon-year goal, statewide efforts are underway to facilitate the State's achievement of that goal and it is reasonable to expect the Project's emissions level (approximately 49,012 metric tonnes of CO_2e per year) to decline as the regulatory initiatives identified by CARB in the First Update are implemented, and other technological innovations occur. Many of these initiatives include reducing the carbon content of motor fuels and fuels for electricity generation.[146] Reducing the carbon content of motor fuels and fuels for electricity generation will reduce CO_2e emissions from this Project over time. Stated differently, the Project's emissions total at build-out represents the maximum emissions inventory for the Project as California's emissions sources are being regulated (and foreseeably expected to continue to be regulated in the future) in furtherance of the State's environmental policy objectives. Given the reasonably anticipated decline in Project emissions once fully constructed and operational, the Project is consistent with the Executive Order's horizon-year goal.

For example, CARB's First Update "lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050." And many of the emission reduction strategies recommended by CARB would serve to reduce the Project's post-2020 emissions level to the extent applicable by law:

- Energy Sector: Continued improvements in California's appliance and building energy efficiency programs and initiatives, such as the State's zero net energy building goals, would serve to reduce the Project's emissions level. Additionally, further additions to California's renewable resource portfolio would favorably influence the Project's emissions level.
- Transportation Sector: Anticipated deployment of improved vehicle efficiency, zero emission technologies, lower carbon fuels, and improvement of existing transportation systems all will serve to reduce the Project's emissions level.
- Water Sector: The Project's emissions level will be reduced as a result of further desired enhancements to water conservation technologies.

[145] Jeffery Greenblatt. 2015. Modeling California Impacts on Greenhouse Gas Emissions. Energy Policy. Volume 78, March 2015, pages 158-172. Abstract available at: http://www.sciencedirect.com/science/article/pii/S0301421514006892. Accessed: January 2015.

[146] California Energy Commission. 2007. State Alternative Fuels Plan. December. CEC-600-2007-011-CMF. Available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF. Accessed: January 2015.

- Waste Management Sector: Plans to further improve recycling, reuse and reduction of solid waste will beneficially reduce the Project's emissions level.

In addition to CARB's First Update, in January 2015, during his inaugural address, Governor Jerry Brown expressed a commitment to achieve "three ambitious goals" that he would like to see accomplished by 2030 to reduce the State's GHG emissions: (1) increasing the State's Renewable Portfolio Standard from 33 percent in 2020 to 50 percent in 2030; (2) cutting the petroleum use in cars and trucks in half; and, (3) doubling the efficiency of existing buildings and making heating fuels cleaner. These expressions of Executive Branch policy may be manifested in adopted legislative or regulatory action through the state agencies and departments responsible for achieving the State's environmental policy objectives, particularly those relating to global climate change.

Given the proportional contribution of mobile source-related GHG emissions to the State's inventory, recent studies[147] also show that relatively new trends, such as the increasing importance of web-based shopping, the emergence of different driving patterns by the "millennial" generation and the increasing effect of Web-based applications on transportation choices, are beginning to substantially influence transportation choices and the energy used by transportation modes. These factors have changed the direction of transportation trends in recent years, and will require the creation of new models to effectively analyze future transportation patterns and the corresponding effect on GHG emissions.

In its First Update, CARB stated the importance of establishing a mid-term statewide GHG reduction target – i.e., set between 2020 and 2050 – to facilitate achievement of the State's long-term GHG reduction goals. To date, however, CARB has not adopted such a target and the Legislature has not authorized one. Nonetheless, for the reasons described above, the Project's post-2020 emissions trajectory is expected to follow a declining trend, consistent with any establishment of a mid-term target. Additionally, as described in Section 4, the Project has been found to be consistent with the 2035 reduction target established by CARB, pursuant to SB 375, for the SCAG region for purposes of securing GHG emission reductions resulting from vehicle miles traveled by passenger vehicles. As shown in table ES-3, Project's traffic-related GHG emissions constitute a substantial percentage of the Project's total emissions inventory, such that the Project's consistency with CARB's 2035 SB 375 target for the SCAG region affirms the Project's compatibility with any mid-term GHG reduction goals for mobile sources established by CARB or the Legislature.

Tables

Table 1. Project Land Uses and Square Footages
Entrada South
Los Angeles County, California

Project Entitlement[1]		Land Use Category	CalEEMod® Analysis		
			Land Use Subtype[2]	Land Use Unit Amount	Size Metric
Elementary School	9.4 acres	Educational	Elementary School	750	students
Public Neighborhood Park	5.6 acres	Recreational	City Park	5.6	acres
Single Family Residential	339 DU	Residential	Single Family Housing	339	DU
2-Story and 2&3 Story Condos	700 DU	Residential	Condo / Townhouse	700	DU
3-Story and 4-Story Condos	535 DU	Residential	Condo / Townhouse High Rise	535	DU
Commercial[3]	280 TSF	Retail	Regional Shopping Center	280	1000sqft
Commercial[3]	15 TSF	Retail	Strip Mall	15	1000sqft
Office	435 TSF	Commercial	General Office Building	435	1000sqft
Parking Structure	16.52 acres	Parking	Unenclosed Parking with Elevator	1,836	spaces
Parking	12.14 acres	Parking	Parking Lot	12.14	acres
Recreational Center[4]	2.9 acres	Recreational	Health Club	2.5	1000sqft
Recreational Center Swimming Pool[4]	6.727 TSF	Not modeled in CalEEMod® for operational GHG analysis.			
External Map Improvements[5]	119.1 acres	Not modeled in CalEEMod® for operational GHG analysis.			
Open Space[5]	92.2 acres	Not modeled in CalEEMod® for operational GHG analysis.			
Spineflower Preserve[5]	27.2 acres	Not modeled in CalEEMod® for operational GHG analysis.			

Notes:

[1] Project entitlement is based on Chapter 3 of the Entrada South Project Draft EIR - Project Description.

[2] Land uses are defined in CalEEMod®.

[3] Commercial areas were classified as Regional Shopping Center and Strip Mall, respectively, based on type of stores expected, area served by stores, acreage, and anticipated trip generation.

[4] One of the recreation centers includes a swimming pool of 6,727 square feet. Swimming pool dimensions is based on a junior size Olympic pool. GHG emissions associated with natural gas heating and electricity usage were calculated outside of CalEEMod® for the CARB 2020 NAT Scenario. For the 2020 Project Scenario, GHG emissions were calculated for electricity usage only since the pool will feature solar heating.

[5] CalEEMod® does not associate any operational emissions with these land uses. GHG emissions due to vegetation change are considered separately (see Table 9).

Abbreviations:

sqft - square feet
CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
DU - dwelling units
EIR - Environmental Impact Report
GHG - greenhouse gases
NAT - No Action Taken
SCAQMD - South Coast Air Quality Management District
TSF - thousand square feet

References:

SCAQMD. 2013. CalEEMod® User's Guide. Available at: http://caleemod.com/. Accessed May 2014.

Table 2. Construction Schedule Assumptions
Entrada South
Los Angeles County, California

Construction Phase[1]	Number of Work Days[2]	Start Date[3]	End Date[3]
Site Preparation	30	12/1/2015	1/11/2016
Grading	250	1/12/2016	12/26/2016
Utility Installation	180	9/19/2016	5/26/2017
Paving 1[4]	15	2/20/2017	3/10/2017
Paving 2[4]	15	8/14/2017	9/1/2017
Building Construction[5]	1,979	6/1/2017	12/31/2024
Architectural Coating[5,6]	440	10/1/2017	12/31/2024

Notes:

[1] Construction phases and duration were based on Project specific estimates.

[2] The construction work week was assumed to be 5 days per week.

[3] Start and end dates were estimated based on duration per phase.

[4] Paving occurs for 30 days during the 140-day period from 2/20/2017 to 9/1/2017. In order to calculate the most conservative peak day emissions, the paving phase was split into two 15-day phases in order to create overlap with adjacent phases.

[5] Building construction and architectural coating are expected to occur over multiple phases. The estimated total activity is represented in this schedule.

[6] The architectural coating phase was estimated to occur intermittently over the presented time period, for a total of 440 days.

Table 3. Construction Equipment Mix Assumptions
Entrada South
Los Angeles County, California

Construction Phase[1]	Equipment Type[1]	# of Unit [1,2]	Usage Hours (per day)[1]	Horsepower[1]
Site Preparation	Crawler Tractor	2	8	82
	On-Highway Truck[3]	2	2	N/A
	Loader/Backhoe	1	6	75
Grading	Scrapers	8	8	356
	Crawler Tractor	4	8	82
	Rubber Tired Dozer	1	20	358
	Other Material Handling Equip (H_20 Truck)	6	8	196
	Grader	1	8	162
	Loader/Backhoe	1	4	75
	Off-Highway Truck	1	4	381
	On-Highway Pick-Up[3]	6	2	N/A
	Excavator	1	1.6	157
Utility Installation	Excavator	2	8	157
	Loader/Backhoe	2	8	75
	On-Highway Truck[3]	2	2	N/A
	On-Highway Pick-Up[3]	2	2	N/A
	Other Material Handling Equip (H_20 Truck)	1	6	196
Paving 1	Grader	1	8	162
	Pavers	1	8	89
	Paving Equipment	1	8	82
	On-Highway Pick-Up[3]	1	2	N/A
	Rollers	1	8	84
Paving 2	Grader	1	8	162
	Pavers	1	8	89
	Paving Equipment	1	8	82
	On-Highway Pick-Up[3]	1	2	N/A
	Rollers	1	8	84
Building Construction	Cranes	1	7	226
	Forklifts	3	8	89
	Generator Sets	1	8	84
	Tractors/Loaders/Backhoes	3	7	97
	Welders	1	8	46
Architectural Coating	Air Compressors	1	6	78

Notes:

[1] The construction equipment mix and usage was based on Project specific estimates except for building construction and architectural coating phases for which CalEEMod® defaults were used.

[2] The equipment activity was estimated based on total hours of operation. To conserve the total hours, some equipment show partial unit numbers.

[3] Emissions from these On-Highway Pick-Ups and Trucks were modeled as on-road worker trips operating on 100% unpaved roads, since CalEEMod® does not have an off-road equipment type that represents these on-highway vehicles.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

H_20 - water

N/A - not available

Table 4a. Construction Worker, Vendor and Hauling Trips
Entrada South
Los Angeles County, California

Category	Units	Buildout Year										
		2015	2016[4]	2017[5]	2018	2019	2020	2021	2022	2023	2024	Total
Land Use Data												
Residential												
2-Story and 2&3 Story Condos	DU				174	228	180	114	4			**700**
3-Story and 4-Story Condos	DU				50	60	60	120	85	60	100	**535**
Single Family Housing	DU				90	144	97	8				**339**
Non Residential												
Public Neighborhood Park[1]	acres					5.6						**5.6**
Elementary School[1]	acres						9.4					**9.4**
Recreational Center	acres							2.9				**2.9**
Office	1000 sqft					97	338					**435**
Commercial (Modeled as Regional Shopping Center)	1000 sqft					280						**280**
Commercial (Modeled as Strip Mall)	1000 sqft					15						**15**
Parking Structure[1]	acres						16.52					**16.52**
Parking[1]	acres					12.14						**12.14**
Construction Schedule												
Construction Duration												
Site Preparation	Total Days	30										
Grading			250									
Utility Installation			180									
Paving				30								
Building Construction[2]				152	261	261	262	261	260	260	262	1,979
Architectural Coating [3]				23	92	125	125	33	17	8	17	440
Average Daily One-Way Trips												
Site Preparation	One-way Trips	8	8									
Grading			58									
Utility Installation			13	13								
Paving				10								
Building Construction												
Worker Trips				**194**	**194**	**385**	**651**	**172**	**64**	**43**	**72**	
Residential				*194*	*194*	*259*	*208*	*171*	*64*	*43*	*72*	
Non Residential				*0*	*0*	*125*	*443*	*1*	*0*	*0*	*0*	
Vendor Trips				**34**	**34**	**110**	**222**	**26**	**10**	**6**	**11**	
Residential				*34*	*34*	*46*	*36*	*26*	*10*	*6*	*11*	
Non Residential				*0*	*0*	*64*	*186*	*0*	*0*	*0*	*0*	
Architectural Coating												
Worker Trips				**39**	**39**	**77**	**130**	**34**	**13**	**9**	**14**	
Residential				*39*	*39*	*52*	*42*	*34*	*13*	*9*	*14*	
Non Residential				*0*	*0*	*25*	*89*	*0*	*0*	*0*	*0*	
Vendor Trips				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Residential				*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Non Residential				*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Total Average Daily One-Way Trips		**8**	**78**	**288**	**266**	**572**	**1,003**	**233**	**86**	**58**	**97**	

Notes:

[1] The Elementary School was modeled in CalEEMod® using 750 students and an estimated building area of 62,704 sqft. The Parking Structure was modeled using 1,836 spaces and an estimated building area of 734,400 sqft. Public Neighborhood Park and Parking (lot) were modeled assuming 0 building sqft.

[2] Annual construction days for Building Construction phase are a Project estimate of 1,979 days.

[3] Annual construction days for Architectural Coating phase are a Project estimate of 440 days.

[4] Based on the construction schedule, in 2016 site preparation will not overlap with grading or utility installation. Therefore the presented average daily one-way trips for 2016 are a conservative estimate.

[5] Based on the construction schedule, in 2017 utility installation will not overlap with building construction. Therefore the presented average daily one-way trips for 2017 are a conservative estimate.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
DU - Dwelling Unit
sqft - square feet

Table 4b. Construction Worker, Vendor and Hauling Trips - Summary
Entrada South
Los Angeles County, California

Construction Phase	Year	Worker Trips Per Day[1]	Onsite Trips modeled as worker trips[2]	Vendor Trips Per Day[1]	Total Hauling Trips[1,3]	Worker One-Way Trip Length (miles)[4]	Vendor One-Way Trip Length (miles)[4]	Hauling One-Way Trip Length (miles)[4]
Site Preparation	2015-2016	8	2	0	64	19.8	7.9	20
Grading	2016	58	6	0	0	19.8	7.9	20
Utility Installation	2016-2017	13	4	0	0	19.8	7.9	20
Paving 1	2017	10	1	0	0	19.8	7.9	20
Paving 2	2017	10	1	0	0	19.8	7.9	20
Building Construction	2017	194	0	34	0	19.8	7.9	20
	2018	194	0	34	0	19.8	7.9	20
	2019	385	0	110	0	19.8	7.9	20
	2020	651	0	222	0	19.8	7.9	20
	2021	172	0	26	0	19.8	7.9	20
	2022	64	0	10	0	19.8	7.9	20
	2023	43	0	6	0	19.8	7.9	20
	2024	72	0	11	0	19.8	7.9	20
Architectural Coating	2017	39	0	0	0	19.8	7.9	20
	2018	39	0	0	0	19.8	7.9	20
	2019	77	0	0	0	19.8	7.9	20
	2020	130	0	0	0	19.8	7.9	20
	2021	34	0	0	0	19.8	7.9	20
	2022	13	0	0	0	19.8	7.9	20
	2023	9	0	0	0	19.8	7.9	20
	2024	14	0	0	0	19.8	7.9	20

Notes:

[1] Worker, vendor and hauling trips are presented as one-way trips per day. One roundtrip consists of two one-way trips, i.e. for a worker/vendor to come to the Site and leave the Site.

[2] Emissions from the operation of on-highway pickups and trucks during the Site Preparation, Grading, Utility Installation and Paving phases were modeled as worker trips assuming total hours of operation as estimated for the Project, an average speed of 10 mph, and a default CalEEMod® trip length of 19.8 miles per one-way trip.

[3] The one-way hauling trips are for vegetation waste.

[4] Trip Length is presented as one-way trip length.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

Table 5. Annual GHG Construction Emissions from Off-Road Equipment[1]
Entrada South
Los Angeles County, California

Construction Phase	CO_2e Emissions (MT)[2]
Site Preparation	11
Grading	2,557
Utility Installation	170
Paving 1	10
Paving 2	10
Building Construction	2,314
Architectural Coating	56
Total	**5,128**

Notes:

[1] Emissions were estimated using CalEEMod® version 2013.2.2.

[2] CO_2e includes CO_2, CH_4, and N_2O emissions, weighted by their respective global warming potentials.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CH_4 - methane
CO_2e - carbon dioxide equivalents
CO_2 - carbon dioxide
GHG - greenhouse gases
MT - metric tonnes
N_2O - nitrous oxide

Table 6. Annual GHG Construction Emissions from On-Road Vehicles
Entrada South
Los Angeles County, California

Construction Phase	CO_2e Emissions (MT)[1,2]			
	Hauling[3]	Vendor	Worker[4]	Total
Site Preparation	66	0	2	68
Grading	0	0	115	115
Utility Installation	0	0	21	21
Paving 1	0	0	1	1
Paving 2	0	0	1	1
Building Construction	0	1,214	2,773	3,987
Architectural Coating	0	0	201	201
			Total	**4,395**

Notes:

[1] Emissions were estimated using CalEEMod® version 2013.2.2.

[2] CO_2e includes CO_2, CH_4, and N_2O emissions, weighted by their respective global warming potentials.

[3] There are vegetation haul trips associated with the site preparation phase, but no external soil hauling trips.

[4] These emissions include emissions from the operation of on-highway pickups and trucks during the Site Preparation, Grading, Utility Installation and Paving phases that are anticipated to be used onsite during these construction phases.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CH_4 - methane
CO_2e - carbon dioxide equivalents
CO_2 - carbon dioxide
GHG - greenhouse gases
MT - metric tonnes
N_2O - nitrous oxide

Table 7. Summary of GHG Construction Emissions
Entrada South
Los Angeles County, California

Year	CO_2e Emissions (MT)[1]		
	Off-Road	**On-Road**	**Total**
2015	9	53	61
2016	2,631	133	2,763
2017	305	289	593
2018	322	457	780
2019	323	1,011	1,334
2020	320	1,754	2,074
2021	307	349	655
2022	304	127	431
2023	303	82	385
2024	306	141	447
Total	5,128	4,395	9,523
		30-yr amortized[2]	**317**

Notes:

[1] Emissions estimated using CalEEMod® version 2013.2.2. See Tables 5 and 6 for detailed emission inventories of the Off-Road Equipment, and On-Road Vehicles categories, respectively.

[2] This approach to one-time construction and vegetation change GHG emissions is based on the GHG Threshold Working Group Meeting #13 Minutes from August 26, 2009. Available at: http://sfprod.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-13/ghg-meeting-13-minutes.pdf?sfvrsn=2. Accessed: May 2014.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
yr - year

Table 8. Number of Net New Trees
Entrada South
Los Angeles County, California

Area	Project	CARB 2020 NAT
	Number of Net New Trees[1]	
Tree Type		
Miscellaneous	3,911	3,911
Oaks[2]	89	89
Total	**4,000**	**4,000**

Notes:
[1] Number of new tree was based on Project specific estimates.

[2] Since CalEEMod® does not include an oak option to model trees, these were modeled as True Fir/Hemlock. Hemlock was chosen among the available options because its longevity is representative of California Oaks.

Abbreviations:
CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
NAT - No Action Taken

Table 9. Vegetation Change Evaluation
Entrada South
Los Angeles County, California

Type of Vegetation Change	Project			CARB 2020 NAT		
	Land Use Change[1]					
	Initial (acres)	Final (acres)	Annual CO_2e emissions[2] (MT)	Initial (acres)	Final (acres)	Annual CO_2e emissions[2] (MT)
Cropland	7.40	0.00	45.88	7.40	0.00	45.88
Grassland	39.10	0.00	168.52	39.10	0.00	168.52
Others[3]	107.50	0.00	0.00	107.50	0.00	0.00
Scrub	244.00	0.00	3,489.20	244.00	0.00	3,489.20
Forest[4]	3.70	0.00	410.70	3.70	0.00	410.70
Wetlands	17.10	0.00	0.00	17.10	0.00	0.00
Total vegetation change	**418.80**	**0.00**	**4,114.30**	**418.80**	**0.00**	**4,114.30**
CO_2e sequestered from Net New Trees (MT)[5]						**-2,836.81**
Total CO_2e emissions released						**1,277.50**
30-yr amortized						**42.58**

Notes:

[1] Land use change was based on Project specific data. Permanent impact was analyzed. For cropland, the permanent disturbance is 7.4 acres and the temporary impact is 0.6 acres. The GHG emissions under existing condition were estimated for a total of 8.0 acres of cropland, as shown in Appendix A.

[2] Emissions were estimated using CalEEMod® version 2013.2.2.

[3] This category represents man-made land cover types, except for Agriculture which is represented by the Cropland category.

[4] This category corresponds to the CalEEMod® category titled 'Trees'.

[5] Total CO_2e sequestered over IPCC recommended 20 year active growth period of new trees. The negative value indicates CO_2 emissions sequestration, as opposed to emissions. See table 8 for number of net new trees.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
IPCC - Intergovernmental Panel on Climate Change
MT - metric tonnes
NAT - No Action Taken
yr - year

Table 10. GHG Emissions from Area Sources (2020 Project)
Entrada South
Los Angeles County, California

Category[1]	Project	Project without PDFs
	CO_2e Emissions (MT/yr)[2]	
Hearth[3,4]	304	342
Landscaping	27	27
Total	**331**	**369**

Notes:

[1] Categories that CalEEMod®classifies as "Area Sources." CalEEMod®does not associate any CO_2e emissions with architectural coating or consumer products.

[2] Emissions were estimated using CalEEMod® version 2013.2.2.

[3] Emissions for the Project scenario were calculated based on a project design feature of 80% of residential units having a gas fireplace. For the Project without PDFs scenario, emissions were calculated based on a default value of 90% of residential units having a gas fireplace.

[4] Assumed no wood burning devices as per SCAQMD Rule 445 and project description.

Abbreviations:

CalEEMod®- CALifornia Emissions Estimator MODel

CO_2e - carbon dioxide equivalents

GHG - greenhouse gases

MT - metric tonnes

PDF - project design feature

SCAQMD - South Coast Air Quality Management District

yr - year

Table 11. GHG Emissions from Area Sources (CARB 2020 NAT)
Entrada South
Los Angeles County, California

Category[1]	CO_2e Emissions (MT/yr)[2]
Hearth[3,4]	342
Landscaping	27
Total	**369**

Notes:

[1] Categories that CalEEMod® classifies as "Area Sources." CalEEMod® does not associate any CO_2e emissions with architectural coating or consumer products.

[2] Emissions were estimated using CalEEMod® version 2013.2.2.

[3] For the CARB 2020 NAT scenario, emissions were calculated based on default value of 90% of residential units having a gas fireplace.

[4] Assumed no wood burning devices as per SCAQMD Rule 445 and project description.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
NAT - No Action Taken
SCAQMD - South Coast Air Quality Management District
yr - year

Table 12. Utility GHG Emission Factor Associated with Renewable Power Standard
Entrada South
Los Angeles County, California

	2006	2007	Average	Units
Total Energy Delivery[1]	82,776,309	83,958,770		MWh
from renewables[2]	12,670,583	12,476,219		MWh
from non-renewables	70,105,726	71,482,551		MWh
% of Total Energy From Renewables[2]	15%	15%		
Total CO_2 Emissions[1]	24,077,133	24,026,108		metric tonnes CO_2
% of Total Energy From Non-Renewables	85%	85%		
CO_2 Emissions per Total Energy Delivered	641.26	630.89	636.07	lbs CO_2/MWh delivered
CO_2 Emissions per Total Non-Renewable Energy[3]	757.16	741.00		lbs CO_2/MWh delivered
Estimated Emission Factors for Total Energy Delivered[4]				
2020 RPS (33%)	**507.3**	**496.5**	**501.9**	lbs CO_2/MWh delivered

Notes:

[1] Total energy delivery and total CO_2 emissions are provided in California-specific SCE Power/Utility Protocol (PUP) Reports available at: http://www.climateregistry.org/tools/carrot/carrot-public-reports.html. The 2006 and 2007 reports are the most recent available data and were both used to conservatively represent the intensity factor of CO_2.

[2] Renewable energy delivered is the sum of biogenic, geothermal and other renewable generations in PUP reports.

[3] The emissions metric presented here was calculated based on the total CO_2 emissions divided by the energy delivered from non-renewable sources.

[4] The emission factors for total energy delivered were estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO_2 emissions per total non-renewable energy metric calculated above. The emission factor presented here is the 33% RPS for 2020. The 33% reduction was used for Project emissions in this report. The estimate provided here and the PUP reports issued by SCE assume that renewable energy sources do not result in any CO_2 emissions.

Abbreviations:

CO_2 - carbon dioxide
GHG - Greenhouse gases
lbs - pounds
MWh - Megawatt hour
PUP - Power/Utility Protocol
RPS - Renewables Portfolio Standard
SCE - Southern California Edison

Table 13. GHG Reduction Calculation for Solar Panels on Commercial and Residential Land Uses (2020 Project)
Entrada South
Los Angeles County, California

Land Use	Rated PV Production[1]	Daily Hours of Operation[2]	Number of PV Systems[1]	Annual Renewable Energy Generated[1]	Annual PV GHG Reduction[3]			
					CO_2	CH_4	N_2O	CO_2e
	(kW/system)	(hr/day)	(system)	(kWh/yr)	(MT/yr)			
Residential	2	4.6	339	1,138,362	259.15	0.015	0.003	260.42
Commercial			228	766,044	174.39	0.010	0.002	175.25
		Total	**567**	**1,904,406**	**433.54**	**0.025**	**0.005**	**435.67**

Commercial Building Area[4]	Effective Roof Area[5]		Number of PV Systems for Commercial Land Use[5]
(sqft)	%	(sqft)	(system)
730,000	50%	365,000	228.13

Notes:

[1] Rated PV production was based on Project commitment of using renewable energy equivalent to placing one 2-kW solar system in every single family residence, and on every 1,600 sqft of effective commercial roof area.

[2] Daily hours of operation were conservatively assumed to be 4.6 hours, which accounts for the efficiency of a solar system with a 30 degree roof slope and a south roof direction for the City of Santa Clarita.

[3] The total Annual PV GHG Reduction was estimated by CalEEMod® 2013.2.2 per the estimated Annual Renewable Energy Generated. The split of emissions between residential and commmercial land uses is based on the ratio of PV systems per land use.

[4] Commercial building area includes General Office Building, Regional Shopping Center and Strip Mall categories.

[5] The effective roof area of commercial land use was conservatively assumed to be half of the building area. The number of PV systems was calculated by dividing the effective roof area by 1,600 sqft.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CO_2 - carbon dioxide
CH_4 - methane
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
kW - kilowatt
kWh - kilowatt-hour
hr - hour
MT - metric tonnes
N_2O - nitrous oxide
PV - photo voltaic
sqft - square feet
yr - year

Table 14a. Derivation of the Electricity and Natural Gas Usage Factors for the Swimming Pool
Entrada South
Los Angeles County, California

Facility Name[1]	Pool Volume[1]	Number of Heaters[1]	Heater Rating[1]	Operation Schedule[1]		Annual Natural Gas Usage[2]	Average Annual Natural Gas Usage[3]	Annual Electricity Usage[4]	Average Annual Electricity
	(gal)		(BTU/hr)	(hrs/day)	(days/yr)	(MMBTU/yr)	(MMBTU/gal/yr)	(KWh/yr)	(kWh/gal/yr)
Fremont Pool	215,000	4	350,000	12	243	4,088	0.023	106,872	0.496
DeFremery Pool	226,659	1	1,738,800	10	243	4,231		105,120	
Live Oak Pool	260,000	4	350,000	12	365	6,132		95,309	
Lyons Pool	240,000	4	350,000	12	365	6,132		110,376	
Temescal Pool	227,605	4	350,000	12	365	6,132		162,060	

Notes:

[1] To estimate the baseline electricity and natural gas energy usage factors for Newhall Land pools, ENVIRON calculated the energy consumption of filter pumps and water heaters of 5 pools in Oakland, California and scaled them to present energy consumption per year per volume of the pool. Oakland pools data including pool volume, number of heaters, heater rating, operation schedule, and annual electricity usage are provided in the City of Oakland Energy Efficient Commercial Pool Program Preliminary Facility Reports.

[2] Annual Natural Gas Usage calculated by multiplying the following factors: (Number of hrs/day) x (Number of days/yr) x (Number of Heaters) x (Heater Rating). Each of these factors were taken from the City of Oakland. Preliminary Facility Reports for DeFremery Pool, Fremont Pool, Live Oak Pool, Lyons Pool, and Temescal Pool.

[3] Average Annual Natural Gas Usage calculated from the Annual Natural Gas Usage of all 5 pools divided by the total Pool Volume of all 5 pools.

[4] Annual Electricity Usage for each pool is shown as reported in the City of Oakland Preliminary Facility Reports for DeFremery Pool, Fremont Pool, Live Oak Pool, Lyons Pool, and Temescal Pool.

[5] Average Annual Electricity Usage calculated from the Annual Electricity Usage of all 5 pools divided by the total Pool Volume of all 5 pools.

Abbreviations:

BTU - british thermal units
gal - gallon
kWh - kilowatt hour
MMBTU - million british thermal units
hrs - hours
yr - year

References:

City of Oakland / Oakland Unified School District. October 2006. Energy Efficient Commercial Pool Program; Preliminary Facility Reports for DeFremery Pool, Fremont Pool, Live Oak Pool, Lyons Pool, and Temescal Pool.

Table 14b. GHG Associated with the Operation of the Swimming Pool[1]
Entrada South
Los Angeles County, California

Category	Energy Use Factor[2]		Pool Volume[3]	Annual Energy Use[4]		Emission Factors[5]		Emissions Per Pool[6]
			(gal)			(lb CO_2e/unit)	(unit)	(MT CO_2e/yr)
Project								
Electricity	0.496	(kWh/gal/yr)	402,598	199,613	(kWh/yr)	0.504	(kWh)	45.67
Natural Gas	0.023	(MMBTU/gal/yr)		0	(MMBTU/yr)	117	(MMBTU)	0
Project without PDFs								
Electricity	0.496	(kWh/gal/yr)	402,598	199,613	(kWh/yr)	0.504	(kWh)	45.67
Natural Gas	0.023	(MMBTU/gal/yr)		5,643	(MMBTU/yr)	117	(MMBTU)	299.47
CARB 2020 NAT								
Electricity	0.496	(kWh/gal/yr)	402,598	199,613	(kWh/yr)	0.633	(kWh)	57.35
Natural Gas	0.023	(MMBTU/gal/yr)		5,643	(MMBTU/yr)	117	(MMBTU)	299.47

Notes:

[1] Emissions were estimated based on Project design feature to install solar heating for the swimming pool.

[2] Energy use factor was based on average annual natural gas and electricity usage derived on Table 14a.

[3] The pool volume was estimated by assuming the size of junior Olympic pool (25m by 25m) and a depth of 8 ft.

[4] Annual energy use was calculated by multiplying the following factors: (Energy Use Factor) x (Pool Volume). Annual energy use assumed that solar heating will replace natural gas heating for the Project Scenario. This feature is not considered in the Project without PDFs Scenario, or the CARB 2020 NAT Scenario.

[5] Emissions factors presented here incorporate utility-specific emission factors for CO_2, CH_4 and N_2O, weighted by their respective GWP. Table 12 shows detailed calculatations for CO_2 emission factors, which are based on a 33% RPS for Project and Project without PDFs Scenarios, and no RPS for the CARB 2020 NAT Scenario.

[6] Emissions per pool calculated by multiplying the following factors: (Annual Energy Use) x (Emission Factor) x (lb/MT Conversion Factor).

Abbreviations:

CARB - California Air Resources Board
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CH_4 - methane
ft - feet
GHG - greenhouse gases
gal - gallons
GWP - global warming potential
kWh - kilowatt hour
lb - pound
m - meter
MMBTU - million british thermal units
MT - metric tonnes
NAT - No Action Taken
N_2O - nitrous oxide
PDF - project design feature
RPS - Renewables Portfolio Standard
yr - year

Table 15. GHG Emissions Associated with Electricity and Natural Gas (2020 Project)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Electricity Use[1]	Natural Gas Use[1]	CO_2e Emissions from Energy Use[2]		
				Associated with Electricity Use	Associated with Natural Gas Burning	Total
		(kWh/yr)	(kBTU/yr)	(MT/yr)		
Project[3]						
Elementary School	Elementary School	246,986.00	682,841.00	56.50	36.66	93.16
City Park	Public Neighborhood Park[4]	(173,128.00)	0.00	(39.61)	0.00	(39.61)
Single Family Housing	Single Family Residential	2,249,270.00	8,073,260.00	514.56	433.44	948.01
Condo / Townhouse	2-Story and 2&3 Story Condos	2,858,170.00	8,079,590.00	653.86	433.78	1,087.64
Condo / Townhouse High Rise	3-Story and 4-Story Condos	2,143,650.00	6,175,110.00	490.40	331.53	821.93
Regional Shopping Center	Commercial	3,662,870.00	375,200.00	837.95	20.14	858.10
Strip Mall	Commercial	32,372.20	20,100.00	7.41	1.08	8.48
General Office Building	Office	5,412,270.00	3,379,950.00	1,238.16	181.46	1,419.62
Unenclosed Parking with Elevator	Parking Structure	1,897,880.00	0.00	434.18	0.00	434.18
Parking Lot	Parking	292,232.00	0.00	66.85	0.00	66.85
Health Club	Recreational Center[5]	54,560.00	36,250.00	12.49	1.95	14.43
	Total	**18,677,132**	**26,822,301**	**4,273**	**1,440**	**5,713**
Project without PDFs[3]						
Elementary School	Elementary School	420,114.00	682,841.00	96.11	36.66	132.77
City Park	Public Neighborhood Park	0.00	0.00	0.00	0.00	0.00
Single Family Housing	Single Family Residential	2,422,400.00	8,073,260.00	554.17	433.44	987.61
Condo / Townhouse	2-Story and 2&3 Story Condos	3,031,300.00	8,079,590.00	693.47	433.78	1,127.25
Condo / Townhouse High Rise	3-Story and 4-Story Condos	2,316,780.00	6,175,110.00	530.01	331.53	861.54
Regional Shopping Center	Commercial	3,836,000.00	375,200.00	877.56	20.14	897.70
Strip Mall	Commercial	205,500.00	20,100.00	47.01	1.08	48.09
General Office Building	Office	5,585,400.00	3,379,950.00	1,277.77	181.46	1,459.23
Unenclosed Parking with Elevator	Parking Structure	2,071,010.00	0.00	473.78	0.00	473.78
Parking Lot	Parking	465,360.00	0.00	106.46	0.00	106.46
Health Club	Recreational Center[5]	227,688.00	5,679,250.00	52.09	301.42	353.51
	Total	**20,581,552**	**32,465,301**	**4,708**	**1,740**	**6,448**

Notes:

[1] Energy and natural gas usage for each land use category was estimated assuming compliance with 2013 Title 24. CalEEMod® distributes electricity usage reduction from renewable energy uniformly across land uses.

[2] Emissions were estimated using CalEEMod® version 2013.2.2.

[3] Electricity use and emissions for the Project Scenario incorporate reductions from the project solar panel commitment detailed in Table 13. These reductions are not taken into account in the Project without PDFs Scenario.

[4] Electricity use and its associated GHG emissions have negative values for City Park due to CalEEMod® distributing the renewable electricity generated from the project solar commitment equally among the land uses. The total renewable electricity is divided by the number of land uses and then subtracted from the electricity use of each land use, resulting in negative values for land uses that have an electricity use lower than this quantity.

[5] The emissions and energy use for the recreational center include those associated with the swimming pool, calculated outside CalEEMod®. See Tables 14a and 14b for details on the calculation.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
kBTU - 1,000 British thermal units
kWh - kilowatt hour
MT - metric tonnes
PDF - project design feature
SCAQMD - South Coast Air Quality Management District
yr - year

References:

SCAQMD. 2013. CalEEMod® User's Guide. Available at: http://caleemod.com/. Accessed May 2014.

Table 16. GHG Emissions Associated with Electricity and Natural Gas (CARB 2020 NAT)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Electricity Use[1]	Natural Gas Use[1]	CO_2e Emissions from Energy Use[2]		
				Associated with Electricity Use	Associated with Natural Gas Burning	Total
		(kWh/yr)	(kBTU/yr)	(MT/yr)		
Elementary School	Elementary School	443,941.00	739,275.00	127.54	39.69	167.23
City Park	Public Neighborhood Park	0.00	0.00	0.00	0.00	0.00
Single Family Housing	Single Family Residential	2,532,260.00	11,004,400.00	727.49	590.81	1,318.30
Condo / Townhouse	2-Story and 2&3 Story Condos	3,124,850.00	10,687,800.00	897.73	573.81	1,471.54
Condo / Townhouse High Rise	3-Story and 4-Story Condos	2,388,280.00	8,168,510.00	686.12	438.56	1,124.68
Regional Shopping Center	Commercial	4,468,800.00	509,600.00	1,283.83	27.36	1,311.19
Strip Mall	Commercial	239,400.00	27,300.00	68.78	1.47	70.24
General Office Building	Office	6,629,400.00	5,411,400.00	1,904.54	290.53	2,195.07
Unenclosed Parking with Elevator	Parking Structure	2,071,010.00	0.00	594.97	0.00	594.97
Parking Lot	Parking	465,360.00	0.00	133.69	0.00	133.69
Health Club	Recreational Center[3]	230,963.00	5,692,500.00	66.35	302.13	368.48
	Total	**22,594,264**	**42,240,785**	**6,491**	**2,264**	**8,755**

Notes:

[1] Energy usage for each land use was estimated assuming "historical conditions". See Appendix A of the CalEEMod® user's guide for details.

[2] Emissions were estimated using CalEEMod® version 2013.2.2. See report for CARB 2020 NAT scenario assumptions.

[3] The emissions and energy use for the recreational center include those associated with the swimming pool, calculated outside CalEEMod®. See Tables 14a and 14b for details on the calculation.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
kBTU - 1,000 British thermal units
kWh - kilowatt hour
MT - metric tonnes
NAT- No Action Taken
PDF - project design feature
SCAQMD - South Coast Air Quality Management District
yr - year

References:

SCAQMD. 2013. CalEEMod® User's Guide. Available at: http://caleemod.com/. Accessed May 2014.

Table 17. GHG Emissions Associated with Water Usage (2020 Project)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Indoor Water Use[1] (Mgal/yr)	Outdoor Water Use[1] (Mgal/yr)	CO_2e Emissions[2] (MT/yr)
Project[3]				
Elementary School	Elementary School	0.80	6.23	19.23
City Park	Public Neighborhood Park	0.00	28.75	73.08
Single Family Housing	Single Family Residential	9.75	18.56	88.31
Condo / Townhouse	2-Story and 2&3 Story Condos	20.13	38.33	182.34
Condo / Townhouse High Rise	3-Story and 4-Story Condos	15.38	29.30	139.36
Regional Shopping Center	Commercial	9.15	16.95	81.69
Strip Mall	Commercial	0.49	0.91	4.38
General Office Building	Office	34.12	63.18	304.51
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00	0.00
Parking Lot	Parking	0.00	0.00	0.00
Health Club	Recreational Center	64.95	0.12	274.27
	Total	**155**	**202**	**1,167**
Project without PDFs[3]				
Elementary School	Elementary School	0.80	6.23	19.23
City Park	Public Neighborhood Park	0.00	28.75	73.08
Single Family Housing	Single Family Residential	9.75	18.56	88.31
Condo / Townhouse	2-Story and 2&3 Story Condos	20.13	38.33	182.34
Condo / Townhouse High Rise	3-Story and 4-Story Condos	15.38	29.30	139.36
Regional Shopping Center	Commercial	9.15	16.95	81.69
Strip Mall	Commercial	0.49	0.91	4.38
General Office Building	Office	34.12	63.18	304.51
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00	0.00
Parking Lot	Parking	0.00	0.00	0.00
Health Club	Recreational Center	64.95	0.12	274.27
	Total	**155**	**202**	**1,167**

Notes:
[1] Water usage was based on Water Demand Projection Memorandum for Entrada South.
[2] Emissions associated with water usage were estimated using CalEEMod® version 2013.2.2.
[3] Water use and emissions for the Project and Project without PDFs scenarios include the use of 378 afy of recycled water to satisfy a portion of the Project's total outdoor, irrigation-related water demand of 668 afy.

Abbreviations:
afy - acre-feet/year
CalEEMod® - CALifornia Emissions Estimator MODel
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
Mgal - million gallons
MT - metric tonnes
PDF - project design feature
yr - year

References:
GSI Water Solutions, Inc. 2014. Water Demand Projections for Entrada Village South. May 16.

Table 18. GHG Emissions Associated with Water Usage (CARB 2020 NAT)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Indoor Water Use[1] (Mgal/yr)	Outdoor Water Use[1] (Mgal/yr)	CO_2e Emissions[2] (MT/yr)
Elementary School	Elementary School	0.96	6.71	26.20
City Park	Public Neighborhood Park	0.00	30.93	98.72
Single Family Housing	Single Family Residential	11.70	19.97	122.00
Condo / Townhouse	2-Story and 2&3 Story Condos	24.16	41.24	251.93
Condo / Townhouse High Rise	3-Story and 4-Story Condos	18.46	31.52	192.54
Regional Shopping Center	Commercial	10.98	18.23	112.90
Strip Mall	Commercial	0.59	0.98	6.05
General Office Building	Office	40.95	67.96	420.86
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00	0.00
Parking Lot	Parking	0.00	0.00	0.00
Health Club	Recreational Center	77.94	0.13	388.56
	Total	**186**	**218**	**1,620**

Notes:

[1] The Project will comply with the California Green Building Standards Code (also called CalGreen Standards), which will require a 20% reduction of indoor potable water use through the use of water saving fixtures and or flow restrictors. As a conservative estimate, the indoor water usage from the Water Demand Report was assumed to be the Project water usage. And thus, the indoor water demand for the Project was increased by 20% to estimate the water demand for the CARB 2020 NAT scenario. Outdoor water demand is based on Water Demand Projection Memorandum for Entrada South. The CARB 2020 NAT scenario assumes that no recycled water will be used.

[2] Emissions associated with water usage were estimated using CalEEMod® version 2013.2.2.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
Mgal - million gallons
MT - metric tonnes
NAT - No Action Taken
yr - year

References:

California Building Standards Commission. 2010. California Green Building Standards. Available at http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf. Accessed: May 2014.

GSI Water Solutions, Inc. 2014. Water Demand Projections for Entrada Village South. May 16.

Table 19. GHG Emissions Associated with Waste Disposal (2020 Project)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Waste Disposed[1,2]	CO_2e Emissions Associated with Waste[1,2]
		(tons/yr)	(MT/yr)
Elementary School	Elementary School	57.56	26.19
City Park	Public Neighborhood Park	14.78	6.72
Single Family Housing	Single Family Residential	394.95	179.67
Condo / Townhouse	2-Story and 2&3 Story Condos	815.56	371.01
Condo / Townhouse High Rise	3-Story and 4-Story Condos	623.11	283.46
Regional Shopping Center	Commercial	786.43	357.76
Strip Mall	Commercial	42.38	19.28
General Office Building	Office	1,221.48	555.67
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00
Parking Lot	Parking	0.00	0.00
Health Club	Recreational Center	0.99	0.45
	Total	**3,957**	**1,800**

Notes:

[1] Solid waste disposal rates were based on actual 2012 disposal rates for the city of Santa Clarita. Solid waste generation and associated emissions for the Project scenario assume 75 percent waste diversion, based on California (statewide) waste diversion goal. Available at: http://www.calrecycle.ca.gov/75percent/. Accessed: June 2014.

[2] There are no PDFs associated with waste disposal, and thus the Project Scenario has the same waste disposed and CO_2e emissions as the Project without PDFs Scenario. The Project and Project without PDFs scenarios assume that the waste diversion goal will be achieved by the State and region.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
PDF - project design feature
yr - year

Table 20. GHG Emissions Associated with Waste Disposal (CARB 2020 NAT)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Waste Disposed[1]	CO_2e Emissions Associated with Waste[1]
		(tons/yr)	(MT/yr)
Elementary School	Elementary School	115.13	52.37
City Park	Public Neighborhood Park	29.57	13.45
Single Family Housing	Single Family Residential	789.90	359.34
Condo / Townhouse	2-Story and 2&3 Story Condos	1,631.11	742.02
Condo / Townhouse High Rise	3-Story and 4-Story Condos	1,246.22	566.93
Regional Shopping Center	Commercial	1,572.86	715.52
Strip Mall	Commercial	84.76	38.56
General Office Building	Office	2,442.96	1,111.34
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00
Parking Lot	Parking	0.00	0.00
Health Club	Recreational Center	1.97	0.90
	Total	**7,914**	**3,600**

Notes:

[1] Solid waste disposal rates were based on actual 2012 disposal rates for the city of Santa Clarita. Solid waste generation and associated emissions for the CARB 2020 NAT scenario assumed 50 percent waste diversion, based on jurisdiction-specific average of per capita generation rates for years 2003 to 2006.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
NAT - No Action Taken
yr - year

Table 21. Calculation of Overall Trip Length
Entrada South
Los Angeles County, California

Land Use Category[1]	External Trip Length (miles)[2]	External ADT[3]	Internal Trip Length (miles)[2]	Internal ADT[4]	Overall Trip Length (miles)[5]
Residential	11.6	10,527	1	1,290	10.44
NonResidential	11.6	16,941	1	2,750	10.12

Notes:

[1] The residential land use category includes Condo/Townhouse, Condo/Townhouse High Rises and Single Family Housing. The NonResidential land use category includes City Park, Elementary School, Recreational Center, General Office building, Regional Shopping Center, and Strip Mall.

[2] External trip length based on the Project Traffic Impact Analysis. The trip length average used by the Project Traffic Impact Analysis is provided in the Santa Clarita Valley Area Plan (also called OVOV Plan). Internal trip length assumed to be 1 mile based on the average distance between residential and commercial locations within the Project site.

[3] Based on average daily trips for the "External - Residential" and "External - Non Residential" categories available on the Internal/External Trip Summary Table in the Project Traffic Impact Analysis.

[4] Since CalEEMod® generally relies upon trips (not tripends) as the basis for inputs to estimate traffic related emissions, the number of tripends by land use provided in the Project Traffic Impact Analysis were converted to trips in order to estimate traffic related emissions in CalEEMod®. See Project report for details.

[5] Overall trip length was input into CalEEMod® 2013.2.2 to estimate emissions from mobile sources.

Abbreviations:

ADT - Average Daily Trips
CalEEMod® - CALifornia Emissions Estimator MODel
OVOV - One Valley One Vision

References:

Los Angeles County Department of Regional Planning. 2012. Santa Clarita Valley Area Plan. Available at: http://planning.lacounty.gov/ovov
Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 22. Trip Calculations using Design Elements and Project Design Features (Project 2020)
Entrada South
Los Angeles County, California

	Total
Traffic Study	
Daily Trip Generation	35,547
Internal Trips (Non-Residential to Residential)[1]	-1,290
Internal Trips (Non-Residential to Non-Residential)[1]	-2,750
Net Daily Trip Generation	**31,507**
Trip Reduction Strategy[2]	
Expand Transit Network [TST-3]	
Percentage Trip Reduction	1.7%
Reduction in Trips	536
Net Site Trips	30,971
Pedestrian Network Improvements [SDT-1]	
Percentage Trip Reduction	2.0%
Reduction in Trips	630
Net Site Trips	30,341
Telecommuting and Alternative Work Schedule [TRT-6]	
Percentage Trip Reduction	0.2%
Reduction in Trips	63
Net Site Trips	30,278
Improve Traffic Flow [RPT-2]	
Percentage Trip Reduction	1.4%
Reduction in Trips	441
Net Site Trips	29,837
Voluntary Commute Trip Reduction [TRT-1]	
Percentage Trip Reduction	1.0%
Reduction in Trips	315
Net Site Trips	29,522
Traffic Calming Measures [SDT-2]	
Percentage Trip Reduction	0.75%
Reduction in Trips	236
Net Site Trips	29,286
Ride-Sharing Programs [TRT-3]	
Percentage Trip Reduction	1.8%
Reduction in Trips	567
Net Site Trips	28,719
Total Trip Reduction Percentage	8.85%
Total Trip Reduction	2,788
Final Net Daily Trip Generation (Project)	**28,719**

Notes:

[1] "Internal trips" from non-residential to residential, and from non-residential to non-residential are subtracted to avoid double counting of trips.

[2] Trip reductions were estimated based on various Project TDMs. The reduction for specific TDMs were estimated in Appendix D of the report: CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295).

Abbreviations:

CAPCOA - California Air Pollution Control Officer's Association
GHG - greenhouse gases
TDM - Transportation Demand Management
VTTM - Vesting Tentative Tract Map

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.
Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 23. Trip Calculations (CARB 2020 NAT)
Entrada South
Los Angeles County, California

	Total
Traffic Study	
Daily Trip Generation	35,547
Internal Trips (Non-Residential to Residential)[1]	-1,290
Internal Trips (Non-Residential to Non-Residential)[1]	-2,750
Net Daily Trip Generation	**31,507**
Trip Reduction Strategy[2]	
Telecommuting and Alternative Work Schedule [TRT-6]	
Percentage Trip Reduction	0.20%
Reduction in Trips	63
Net Site Trips	31,444
Total Trip Reduction Percentage	0.20%
Total Trip Reduction	63
Final Net Daily Trip Generation (Project)	**31,444**

Notes:

[1] "Internal trips" from non-residential to residential, and from non-residential to non-residential are subtracted to avoid double counting of trips.

[2] Trip reductions were estimated based on Project TDM TRT-6. The reduction for specific TDMs were estimated in Appendix D of the report: CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295).

Abbreviations:

CAPCOA - California Air Pollution Control Officer's Association
CARB - California Air Resources Board
GHG - greenhouse gas
NAT - No Action Taken
TDM - Transportation Demand Management
VTTM - Vesting Tentative Tract Map

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.
Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 24. CalEEMod® Model Inputs Associated with Traffic (2020 Project)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Unit	Trip Rates[1] (trips/day/unit)			Trip type[2] %		
			Weekday	Saturday	Sunday	Primary	Diverted	Pass-By
Project[3]								
Elementary School	Elementary School	students	1.03	0.00	0.00	100	0	0
City Park	Public Neighborhood Park	acres	1.79	1.79	1.79	100	0	0
Single Family Housing	Single Family Residential	DU	6.84	7.21	6.27	100	0	0
Condo / Townhouse	2-Story and 2&3 Story Condos	DU	6.84	7.44	6.30	100	0	0
Condo / Townhouse High Rise	3-Story and 4-Story Condos	DU	6.84	7.44	6.30	100	0	0
Regional Shopping Center	Commercial	1000sqft	43.27	50.35	25.43	100	0	0
Strip Mall	Commercial	1000sqft	68.04	64.54	31.36	100	0	0
General Office Building	Office	1000sqft	9.25	1.99	0.82	100	0	0
Unenclosed Parking with Elevator	Parking Structure	spaces	0.00	0.00	0.00	100	0	0
Parking Lot	Parking	acres	0.00	0.00	0.00	100		
Health Club	Recreational Center	1000sqft	2.07	1.31	1.68	100	0	0
Project without PDFs[3]								
Elementary School	Elementary School	students	1.13	0.00	0.00	100	0	0
City Park	Public Neighborhood Park	acres	1.96	1.96	1.96	100	0	0
Single Family Housing	Single Family Residential	DU	7.51	7.91	6.88	100	0	0
Condo / Townhouse	2-Story and 2&3 Story Condos	DU	7.51	8.16	6.92	100	0	0
Condo / Townhouse High Rise	3-Story and 4-Story Condos	DU	7.51	8.16	6.92	100	0	0
Regional Shopping Center	Commercial	1000sqft	47.47	55.24	27.90	100	0	0
Strip Mall	Commercial	1000sqft	74.64	70.80	34.41	100	0	0
General Office Building	Office	1000sqft	10.14	2.18	0.90	100	0	0
Unenclosed Parking with Elevator	Parking Structure	spaces	0.00	0.00	0.00	100	0	0
Parking Lot	Parking	acres	0.00	0.00	0.00	100	0	0
Health Club	Recreational Center	1000sqft	2.28	1.44	1.85	100	0	0

Notes:

[1] Trip Rates based on the average daily trips provided by land use in the Project Traffic Impact Analysis. Weekend trip were rates proportionally adjusted to reflect initial weekday/weekend split in CalEEMod® version 2013.2.2. The traffic model used in the Project Traffic Impact Analysis assumed different trip rate for single family homes and condos, but generated a weighted trip rate for all residential units. Using this weighted trip rate for the GHG emissions estimate is mathematically equivalent to using the individual trip rates for the different residential land uses.

[2] Traffic study accounts for primary, diverted and pass-by trips. Hence trip type % was assumed to be 100% primary trip.

[3] Trip rates for the Project Scenario incorporate a reduction of 8.85% based on TDMs outlined in Appendix D of the report: CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). TDM reductions are not included in the trip rate calculation for the Project without PDFs Scenario.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CAPCOA - California Air Pollution Control Officer's Association
DU - dwelling unit
GHG - greenhouse gases
PDF - project design feature
sqft - square feet
TDM - transportation demand management
VTTM - Vesting Tentative Tract Map

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.
Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 25. CalEEMod® Model Inputs Associated with Traffic (CARB 2020 NAT)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Unit	Trip Rates[1,2] (trips/day/unit)		
			Weekday	Saturday	Sunday
Elementary School	Elementary School	students	1.13	0.00	0.00
City Park	Public Neighborhood Park	acres	1.96	1.96	1.96
Single Family Housing	Single Family Residential	DU	7.49	7.89	6.87
Condo / Townhouse	2-Story and 2&3 Story Condos	DU	7.49	8.14	6.90
Condo / Townhouse High Rise	3-Story and 4-Story Condos	DU	7.49	8.14	6.90
Regional Shopping Center	Commercial	1000sqft	47.38	55.13	27.85
Strip Mall	Commercial	1000sqft	74.49	70.66	34.34
General Office Building	Office	1000sqft	10.12	2.18	0.90
Unenclosed Parking with Elevator	Parking Structure	spaces	0.00	0.00	0.00
Parking Lot	Parking	acres	0.00	0.00	0.00
Health Club	Recreational Center	1000sqft	2.27	1.44	1.84

Notes:

[1] Trip Rates and trip type percentages were based on the Project Traffic Impact Analysis. Weekend trip rates were proportionally adjusted to reflect initial weekday/weekend split in CalEEMod® version 2013.2.2. Trip rates were calculated incorporating a reduction of 0.2% based on the telecommuting centers TDM.

[2] Traffic study accounts for primary, diverted and pass-by trips. Hence trip type % was assumed to be 100% primary trip.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CAPCOA - California Air Pollution Control Officer's Association
CARB - California Air Resources Board
DU - dwelling unit
NAT - no action Taken
sqft - square feet
TDM - transportation demand management
VTTM - Vesting Tentative Tract Map

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.
Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 26. GHG Emissions Associated with Traffic (2020 Project)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Vehicles Miles Travelled (VMT/yr)	CO_2e Emissions Associated with Traffic[1] (MT/yr)
Project[2]			
Elementary School	Elementary School	2,032,602	799.97
City Park	Public Neighborhood Park	36,925	14.53
Single Family Housing	Single Family Residential	8,774,852	3,453.52
Condo / Townhouse	2-Story and 2&3 Story Condos	18,217,967	7,170.04
Condo / Townhouse High Rise	3-Story and 4-Story Condos	13,923,732	5,479.96
Regional Shopping Center	Commercial	43,044,538	16,941.03
Strip Mall	Commercial	3,442,399	1,354.82
General Office Building	Office	11,230,540	4,420.00
Unenclosed Parking with Elevator	Parking Structure	0	0.00
Parking Lot	Parking	0	0.00
Health Club	Recreational Center	17,550	6.91
	Total	**100,721,105**	**39,641**
Project without PDFs[2]			
Elementary School	Elementary School	2,229,942	877.64
City Park	Public Neighborhood Park	40,432	15.91
Single Family Housing	Single Family Residential	9,632,461	3,791.04
Condo / Townhouse	2-Story and 2&3 Story Condos	20,000,242	7,871.49
Condo / Townhouse High Rise	3-Story and 4-Story Condos	15,285,899	6,016.07
Regional Shopping Center	Commercial	47,223,304	18,585.66
Strip Mall	Commercial	3,776,377	1,486.27
General Office Building	Office	12,311,016	4,845.24
Unenclosed Parking with Elevator	Parking Structure	0	0.00
Parking Lot	Parking	0	0.00
Health Club	Recreational Center	19,326	7.61
	Total	**110,519,000**	**43,497**

Notes:

[1] Emissions were estimated using CalEEMod® version 2013.2.2. Emissions associated with Traffic included emissions during running, idling, and startup of vehicles. See report for design elements, Project design features and assumptions.

[2] Emissions for the Project Scenario incorporate the TDMs outlined in Appendix D of the report: CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). TDM reductions are not reflected in the Traffic emissions for the Project without PDFs Scenario.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CAPCOA - California Air Pollution Control Officer's Association
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
PDF - project design feature
TDM - transportation demand management
VMT - vehicle miles travelled
VTTM - Vesting Tentative Tract Map
yr - year

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.

Stantec. 2014. Entrada South (VTTM 053295) Traffic Impact Analysis. June.

Table 27. GHG Emissions Associated with Traffic (CARB 2020 NAT)
Entrada South
Los Angeles County, California

CalEEMod® Land Use	Project Entitlement	Vehicles Miles Travelled (VMT/yr)	CO_2e Emissions Associated with Traffic[1] (MT/yr)
Elementary School	Elementary School	2,229,942.00	1,156.53
City Park	Public Neighborhood Park	40,432.07	20.97
Single Family Housing	Single Family Residential	9,608,536.27	4,983.35
Condo / Townhouse	2-Story and 2&3 Story Condos	19,947,039.84	10,345.28
Condo / Townhouse High Rise	3-Story and 4-Story Condos	15,245,237.59	7,906.75
Regional Shopping Center	Commercial	47,133,422.34	24,445.16
Strip Mall	Commercial	3,768,799.32	1,954.64
General Office Building	Office	12,288,124.99	6,373.08
Unenclosed Parking with Elevator	Parking Structure	0.00	0.00
Parking Lot	Parking	0.00	0.00
Health Club	Recreational Center	19,247.23	9.98
	Total	**110,280,782**	**57,196**

Notes:

[1] Emissions were estimated using CalEEMod® version 2013.2.2. Emissions associated with traffic included emissions during running, idling, and startup of vehicles. Traffic emissions were calculated incorporating a trip rate reduction of 0.2% based on the telecommuting centers TDM. Emissions were also calculated assuming that the Pavley, LCFS regulations, and Advanced Clean Car Program are not in place.

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CAPCOA - California Air Pollution Control Officer's Association
CARB - California Air Resources Board
CO_2e - carbon dioxide equivalent
GHG - greenhouse gases
LCFS - Low Carbon Fuel Standard
MT - metric tonnes
NAT - No Action Taken
TDM - transportation demand management
VMT - vehicle miles traveled
VTTM - Vesting Tentative Tract Map
yr - year

References:

Stantec. 2014. CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295). July.

Table 28. Summary of CARB 2020 NAT and 2020 Project Scenario Assumptions
Entrada South
Los Angeles County, California

	CARB 2020 NAT	2020 Project
Electricity CO_2 intensity factor	Based on CalEEMod® default SCE intensity factor.	SCE intensity factor adjusted for 33% RPS.
Vehicle trips:		
Number of trips generated	Based on the Project Traffic Study trip rates. Trip rates are reduced to account for double counting in internal trips.	
Project Design Feature trip reductions	This analysis accounts for trip reductions due to an estimated level of telecommuting by residents. A of total of 0.2% of total trips were reduced due to Project TDM's.	Based on Project Traffic Study and CAPCOA GHG Reduction Strategies report which estimates trip reductions due to design elements and Project Design Features (i.e. including Transit Network Expansion, Pedestrian Network Improvements, Traffic Calming, Implementation of Voluntary Commute Trip Reduction Program, Implementation of Ride-Sharing Programs, Encouraging Telecommuting and Alternative Work Schedules, and Traffic Flow Improvement). The analysis also accounts for trip reductions due to an estimated level of telecommuting by residents. A of total of 8.85% of total trips were reduced due to Project TDM's.
Vehicle emission factor	Assumed LCFS, Pavley regulations and Advanced Clean Cars program are not in place.	Assumed LCFS, Pavley regulations and Advanced Clean Cars program are in place.
Fireplaces	Assumed there are no wood-burning fireplaces based on SCAQMD regulation. Assumed 10% of dwelling units have no fireplaces consistent with CalEEMod® version 2013.2.2 default. The remaining 90% of the total dwelling units are to have natural gas-fired fireplaces.	Assumed there are no wood-burning fireplaces based on SCAQMD regulation. Assumed a total of 20% dwelling units have no fireplaces which is 10% greater than CalEEMod® version 2013.2.2 default. The remaining 80% of the total dwelling units are to have natural gas-fired fireplaces.
Energy use	Building energy intensity based on Title 24 - 2005. Recreational swimming pool is heated by natural gas.	Building energy intensity based on Title 24 - 2013. Recreational swimming pool is heated by solar powered energy. Solar panels on a portion of the residential and commercial land uses.
Water use	Water usage is assumed to be 20% higher than the Project to account for the Project's compliance with the California Green Building Standards Code. Assumed no recycled water use.	Based on Water Demand Projection Memorandum for Entrada South. Water demand assumes compliance with the California Green Building Standards Code. Included the use of 378 afy of recycled water to satisfy a portion of the Project's total outdoor, irrigation-related water demand of 668 afy
Solid Waste generation	Waste diversion of 50% (based on actual 2012 disposal rates for the city of Santa Clarita).	Waste diversion of 75% (2020 California State Goal).
Vegetation	Additional 4,000 trees to be planted.	

Abbreviations:

afy - acre-feet/year
CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
CO_2 - carbon dioxide
LCFS - Low Carbon Fuel Standard
NAT - No Action Taken
RPS - Renewable Portfolio Standards
SCAQMD - South Coast Air Quality Management District
SCE - Southern California Edison
TDM - transportation demand management

Appendix A

Calculation Methodology on GHG Emissions under Existing Conditions

Summary of Existing Conditions

This Appendix summarizes ENVIRON International Corporation's (ENVIRON) estimates for existing greenhouse gas (GHG) emissions associated with the Project site.

The Project site is generally comprised of vacant land, some agricultural uses, a small plant nursery used by the adjacent Six Flags Magic Mountain, and abandoned oil wells and associated access roads. The agricultural area, approximately 7.45 acres in size and used as pasture, would be permanently eliminated during Project buildout. The Project site is periodically leased to the movie industry for set locations. All other existing uses are assumed to produce negligible GHG emissions.

In light of the existing conditions, ENVIRON evaluated the following sources that currently exist on the project site:

1. Farmland/Agricultural Operations
    a. Water use
    b. Fertilizer
    c. Equipment

Please note that emissions associated with the periodic lease of the Entrada South Village area to the movie industry were not accounted for in this emissions estimate as such activities are intermittent, limited and unpredictable. Additionally, the emissions estimate does not account for the minor existing structures within the Entrada South Village area since these are not expected to emit greenhouse gases. Furthermore, the emissions estimate does not account for the limited vehicular trips from/to the site associated with the farmland/agricultural operations or any other miscellaneous purposes as such activities are very limited.

ENVIRON estimated the emissions associated with the existing site conditions, and particularly farmland, to be roughly 13.2 metric tons of CO_2e per year (Table ES-1).

Farming/Agricultural Operations

Table A-1 outlines ENVIRON's approach to calculating GHG emissions from farming operations that would be eliminated due to project building. GHG emissions include indirect emissions associated with estimated water use, and direct emissions associated with fertilizer and equipment use. While a variety of crops and vegetables may have been grown on the site, ENVIRON relied upon general crop water use factors, and general corn fertilizer factors and equipment-use factors, due to limited data availability. ENVIRON does not expect these assumptions to systematically over- or underestimate actual emissions. ENVIRON then used appropriate emission factors to determine GHG emissions from water use, fertilizer emissions and equipment fuel use. Table A-2 summarizes the GHG emissions from farming operations.

Table A-1. Existing Conditions - Farming
Entrada South
Los Angeles County, California

Description	Activity Data	Units	Source(s)
Area of disturbed farmland	7.45	acre	Entrada South Greenhouse Gas Emissions Technical Report, Table 9
US average amount of water used for irrigation, in 2008	1.66	acre-feet water/acre irrigated	USDA. Farm and Ranch Irrigation Survey. 2008. Table 12. Available from: http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Farm_and_Ranch_Irrigation_Survey/fris08_1_12.pdf. Accessed January 21, 2014.
Total acre-feet used	12.37	acre-feet	Calculations: Area of disturbed farmland * US average amount of water used for irrigation, in 2008
kWh/acre-foot	3,170	kWh/acre-feet	California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. Table ES-1. Available from: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF. Accessed January 21, 2014.
Electricity use for water	39,225	kWh/year	Calculations: Total acre-feet used * kWh/acre-foot
CO_2 Emission Factor for electricity used	630.89	lb CO_2/MWh	Entrada South Greenhouse Gas Emissions Technical Report, Table 12
Crop grown on an acre, per year	145.2	bu	USDA. 2013. Feeds Grain Database. Average US Corn Yield Per Acre for 1998-2013. Available from: http://www.ers.usda.gov/data-products/feed-grains-database/feed-grains-custom-query.aspx. Accessed January 22, 2014.
Crop grown on an acre, per year	3,688.89	kg	Calculations: Crop grown on an acre (in bu) * 56 lb per corn bu * 0.453592 kg per lbs (Conversion factor of bu to lbs from: NREL. 2014. US Life Cycle Inventory Database. Available from: https://www.lcacommons.gov/nrel/search. Accessed January 21, 2014.)
Nitrogen fertilizar required to produce 1 kg of crop	0.0169	kg	NREL. 2014. US Life Cycle Inventory Database. Available from: https://www.lcacommons.gov/nrel/search. Accessed January 21, 2014.
Nitrogen fertilizar required for 1 acre of crop production	62.3	kg	Calculations: Crop grown on an acre, per year (in kg) * Nitrogen fertilizer required to produce 1 kg of crop
Nitrogen fertilizer required for acreage	464	kg	Calculations: Area of disturbed farmland * Nitrogen fertilizer required for one acre of crop production
N_2O Emission Factor for emissions from synthetic/organic N inputs	1%	--	IPCC. 2006. Guidelines for National Greenhouse Gas Inventories. Table 11.1. Available from: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf. Accessed January 21, 2014.
Total N_2O Emissions	4.64	kg	Calculations: Nitrogen fertilizer required for acreage * N_2O Emission Factor for emissions from N inputs
GWP of N_2O	310	--	IPCC. 1995. Second Assessment Report: Climate Change. Available from: http://www.ipcc.ch/ipccreports/sar/wg_I/ipcc_sar_wg_I_full_report.pdf. Accessed April 07, 2014.
Total N_2O Emissions (in CO_2e)	1,440	kg	Calculations: Total N_2O Emissions * GWP of N_2O
Tractor diesel fuel usage rate	6.85	gallon/acre	USDA. 2001. The 2001 Net Energy Balance of Corn-Ethanol. Table 1. Available from: https://www.ethanol.org/pdf/contentmgmt/USDA_energy_balance_04.pdf. Accessed January 22, 2014.
Diesel fuel usage for acreage	51.0325	gallon	Calculations: Area of disturbed farmland * Tractor diesel fuel usage rate
CO_2 Emission Factor per unit volume for diesel fuel	10.15	kg CO_2/gallon	The Climate Registry. 2008. General Reporting Protocol. Table 13.1. Available from: http://www.theclimateregistry.org/downloads/GRP.pdf. Accessed January 21, 2014.

Abbreviations:
bu - bushel
CO_2e - carbon dioxide equivalents
GWP - global warming potential
IPCC - Interngovernmental Panel on Climate Change
kg - kilogram
kW - kilowatts
kWh - kilowatt-hour
lb - pound
MT - metric ton
MWh - megawatt-hour
N - nitrogen
N_2O - nitrous oxide
NREL - National Renewable Energy Laboratory
USDA - United States Department of Agriculture

Table A-2. Existing Conditions - Total Emissions
Entrada South
Los Angeles County, California

Description	Activity Data	Units	Source(s)
Energy use associated with water	11.2	MT CO_2e	Calculations: [Electricity use for water (in kWh) * 0.001 MWh per kWh * CO_2 Emission Factor for electricity used (in lb CO_2 per MWh)] / 2,204.62 lb per MT
N_2O Emissions associated with fertilizer use	1.4	MT CO_2e	Calculations: Total N_2O Emissions (in kg CO_2e) / 1000 kg per MT
Diesel fuel usage	0.5	MT CO_2e	Calculations: [Diesel fuel usage * CO_2 Emission Factor for diesel] / 1000 kg per MT
Total	13.2	MT CO_2e	

Abbreviations:
CO_2e - carbon dioxide equivalents
kg - kilogram
kWh - kilowatt-hour
lb - pound
MT - metric ton
MWh - megawatt-hour
N_2O - nitrous oxide

Appendix B

CalEEMod® Output Files

Table B-1. CalEEMod® Model Outputs Descriptions
Entrada South
Los Angeles County, California

Construction CalEEMod® Runs		
Output	**Phases**	**Source Categories**
Output 1 - Annual/Summer/Winter	Site Preparation, Grading and Paving 1/2	Offroad Equipment, and Offsite Onroad Vehicles
Output 2 - Annual/Summer/Winter	Utility Installation and Building Construction	Offroad Equipment, and Offsite Onroad Vehicles Except for Worker and Vendor Vehicles for Building Construction
Output 2a - Annual/Summer/Winter	Building Construction	Worker and Vendor Vehicles for Building Construction
Output 3 - Annual/Summer/Winter	Architectural Coating	Offroad Equipment, Offsite Onroad Vehicles, and VOC from Coating and Paving
Output 4 - Annual/Summer/Winter	Site Preparation, Grading and Paving 1/2	Onsite Onroad Vehicles
Output 5 - Annual/Summer/Winter	Utility Installation and Building Construction	Onsite Onroad Vehicles

Operational CalEEMod® Runs		
Output	**Scenario**	**Purpose**
Scenario 2 - Annual	2020 Project	GHG emissions
Scenario 2a - Annual	2020 Project without PDFs	GHG emissions
Scenario 3 - Annual	CARB 2020 NAT	GHG emissions

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel
CARB - California Air Resources Board
GHG - greenhouse gases
NAT - no action Taken
PDF - project design feature

Entrada South - Construction Emissions - Site Preparation, Grading & Paving

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Restoring CalEEMod Defaults since some equipment was entered with different unit amount and hours to account for unit fractions.

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Grading -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40

tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0309	0.3770	0.2624	6.6000e-004	0.0328	0.0147	0.0474	6.2400e-003	0.0135	0.0197	0.0000	60.8186	60.8186	3.0900e-003	0.0000	60.8834
2016	2.8352	33.3950	20.2543	0.0285	3.4105	1.4857	4.8962	1.2184	1.3669	2.5852	0.0000	2,662.5877	2,662.5877	0.7731	0.0000	2,678.8217
2017	0.0613	0.2785	0.1771	2.4000e-004	2.2100e-003	0.0183	0.0205	5.9000e-004	0.0168	0.0174	0.0000	21.9708	21.9708	6.2100e-003	0.0000	22.1012
Total	**2.9274**	**34.0505**	**20.6938**	**0.0294**	**3.4454**	**1.5187**	**4.9641**	**1.2252**	**1.3972**	**2.6224**	**0.0000**	**2,745.3770**	**2,745.3770**	**0.7824**	**0.0000**	**2,761.8063**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0309	0.3770	0.2624	6.6000e-004	0.0231	0.0147	0.0377	5.2000e-003	0.0135	0.0187	0.0000	60.8185	60.8185	3.0900e-003	0.0000	60.8834
2016	2.8352	33.3950	20.2543	0.0285	1.4037	1.4857	2.8895	0.4946	1.3669	1.8615	0.0000	2,662.5846	2,662.5846	0.7731	0.0000	2,678.8187
2017	0.0613	0.2785	0.1771	2.4000e-004	2.2100e-003	0.0183	0.0205	5.9000e-004	0.0168	0.0174	0.0000	21.9708	21.9708	6.2100e-003	0.0000	22.1012
Total	**2.9274**	**34.0504**	**20.6938**	**0.0294**	**1.4290**	**1.5187**	**2.9477**	**0.5004**	**1.3972**	**1.8976**	**0.0000**	**2,745.3739**	**2,745.3739**	**0.7824**	**0.0000**	**2,761.8032**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**58.52**	**0.00**	**40.62**	**59.16**	**0.00**	**27.64**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6438**	**0.2703**	**50,832.7470**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6426**	**0.2701**	**50,832.6439**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	8.00	0.00	1,920.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	58.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

Paving2	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0159	0.0000	0.0159	1.7200e-003	0.0000	1.7200e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1301	0.0761	9.0000e-005		0.0108	0.0108		9.9400e-003	9.9400e-003	0.0000	8.6876	8.6876	2.5900e-003	0.0000	8.7421
Total	**0.0151**	**0.1301**	**0.0761**	**9.0000e-005**	**0.0159**	**0.0108**	**0.0267**	**1.7200e-003**	**9.9400e-003**	**0.0117**	**0.0000**	**8.6876**	**8.6876**	**2.5900e-003**	**0.0000**	**8.7421**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0154	0.2461	0.1775	5.5000e-004	0.0155	3.8600e-003	0.0193	4.1600e-003	3.5500e-003	7.7100e-003	0.0000	50.7672	50.7672	4.2000e-004	0.0000	50.7759
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	5.1000e-004	8.6000e-004	8.8500e-003	2.0000e-005	1.3600e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.3637	1.3637	8.0000e-005	0.0000	1.3654
Total	**0.0159**	**0.2469**	**0.1864**	**5.7000e-004**	**0.0169**	**3.8700e-003**	**0.0207**	**4.5200e-003**	**3.5600e-003**	**8.0800e-003**	**0.0000**	**52.1309**	**52.1309**	**5.0000e-004**	**0.0000**	**52.1413**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.2000e-003	0.0000	6.2000e-003	6.7000e-004	0.0000	6.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1301	0.0761	9.0000e-005		0.0108	0.0108		9.9400e-003	9.9400e-003	0.0000	8.6876	8.6876	2.5900e-003	0.0000	8.7421
Total	**0.0151**	**0.1301**	**0.0761**	**9.0000e-005**	**6.2000e-003**	**0.0108**	**0.0170**	**6.7000e-004**	**9.9400e-003**	**0.0106**	**0.0000**	**8.6876**	**8.6876**	**2.5900e-003**	**0.0000**	**8.7421**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0154	0.2461	0.1775	5.5000e-004	0.0155	3.8600e-003	0.0193	4.1600e-003	3.5500e-003	7.7100e-003	0.0000	50.7672	50.7672	4.2000e-004	0.0000	50.7759
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.1000e-004	8.6000e-004	8.8500e-003	2.0000e-005	1.3600e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.3637	1.3637	8.0000e-005	0.0000	1.3654
Total	**0.0159**	**0.2469**	**0.1864**	**5.7000e-004**	**0.0169**	**3.8700e-003**	**0.0207**	**4.5200e-003**	**3.5600e-003**	**8.0800e-003**	**0.0000**	**52.1309**	**52.1309**	**5.0000e-004**	**0.0000**	**52.1413**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0159	0.0000	0.0159	1.7200e-003	0.0000	1.7200e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4800e-003	0.0386	0.0231	3.0000e-005		3.2000e-003	3.2000e-003		2.9500e-003	2.9500e-003	0.0000	2.6150	2.6150	7.9000e-004	0.0000	2.6316
Total	**4.4800e-003**	**0.0386**	**0.0231**	**3.0000e-005**	**0.0159**	**3.2000e-003**	**0.0191**	**1.7200e-003**	**2.9500e-003**	**4.6700e-003**	**0.0000**	**2.6150**	**2.6150**	**7.9000e-004**	**0.0000**	**2.6316**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.1000e-003	0.0662	0.0501	1.7000e-004	0.0133	9.3000e-004	0.0143	3.3900e-003	8.6000e-004	4.2400e-003	0.0000	15.2802	15.2802	1.1000e-004	0.0000	15.2826
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	2.4000e-004	2.4400e-003	1.0000e-005	4.1000e-004	0.0000	4.2000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.4012	0.4012	2.0000e-005	0.0000	0.4017
Total	**4.2400e-003**	**0.0664**	**0.0526**	**1.8000e-004**	**0.0138**	**9.3000e-004**	**0.0147**	**3.5000e-003**	**8.6000e-004**	**4.3500e-003**	**0.0000**	**15.6814**	**15.6814**	**1.3000e-004**	**0.0000**	**15.6842**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					6.2000e-003	0.0000	6.2000e-003	6.7000e-004	0.0000	6.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4800e-003	0.0386	0.0231	3.0000e-005		3.2000e-003	3.2000e-003		2.9500e-003	2.9500e-003	0.0000	2.6150	2.6150	7.9000e-004	0.0000	2.6316
Total	**4.4800e-003**	**0.0386**	**0.0231**	**3.0000e-005**	**6.2000e-003**	**3.2000e-003**	**9.4000e-003**	**6.7000e-004**	**2.9500e-003**	**3.6200e-003**	**0.0000**	**2.6150**	**2.6150**	**7.9000e-004**	**0.0000**	**2.6316**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	4.1000e-003	0.0662	0.0501	1.7000e-004	0.0133	9.3000e-004	0.0143	3.3900e-003	8.6000e-004	4.2400e-003	0.0000	15.2802	15.2802	1.1000e-004	0.0000	15.2826
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-004	2.4000e-004	2.4400e-003	1.0000e-005	4.1000e-004	0.0000	4.2000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.4012	0.4012	2.0000e-005	0.0000	0.4017
Total	**4.2400e-003**	**0.0664**	**0.0526**	**1.8000e-004**	**0.0138**	**9.3000e-004**	**0.0147**	**3.5000e-003**	**8.6000e-004**	**4.3500e-003**	**0.0000**	**15.6814**	**15.6814**	**1.3000e-004**	**0.0000**	**15.6842**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.2738	0.0000	3.2738	1.1847	0.0000	1.1847	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7906	33.2291	19.5479	0.0269		1.4806	1.4806		1.3621	1.3621	0.0000	2,540.4145	2,540.4145	0.7663	0.0000	2,556.5064
Total	**2.7906**	**33.2291**	**19.5479**	**0.0269**	**3.2738**	**1.4806**	**4.7544**	**1.1847**	**1.3621**	**2.5469**	**0.0000**	**2,540.4145**	**2,540.4145**	**0.7663**	**0.0000**	**2,556.5064**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0360	0.0610	0.6308	1.3500e-003	0.1070	1.0100e-003	0.1080	0.0284	9.3000e-004	0.0293	0.0000	103.8767	103.8767	5.8500e-003	0.0000	103.9995
Total	**0.0360**	**0.0610**	**0.6308**	**1.3500e-003**	**0.1070**	**1.0100e-003**	**0.1080**	**0.0284**	**9.3000e-004**	**0.0293**	**0.0000**	**103.8767**	**103.8767**	**5.8500e-003**	**0.0000**	**103.9995**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.2768	0.0000	1.2768	0.4621	0.0000	0.4621	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7906	33.2290	19.5478	0.0269		1.4806	1.4806		1.3621	1.3621	0.0000	2,540.4115	2,540.4115	0.7663	0.0000	2,556.5034
Total	**2.7906**	**33.2290**	**19.5478**	**0.0269**	**1.2768**	**1.4806**	**2.7574**	**0.4621**	**1.3621**	**1.8242**	**0.0000**	**2,540.4115**	**2,540.4115**	**0.7663**	**0.0000**	**2,556.5034**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0360	0.0610	0.6308	1.3500e-003	0.1070	1.0100e-003	0.1080	0.0284	9.3000e-004	0.0293	0.0000	103.8767	103.8767	5.8500e-003	0.0000	103.9995
Total	**0.0360**	**0.0610**	**0.6308**	**1.3500e-003**	**0.1070**	**1.0100e-003**	**0.1080**	**0.0284**	**9.3000e-004**	**0.0293**	**0.0000**	**103.8767**	**103.8767**	**5.8500e-003**	**0.0000**	**103.9995**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.8900e-003	1.0000e-005	1.1100e-003	1.0000e-005	1.1200e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0343	1.0343	6.0000e-005	0.0000	1.0355

Total	**3.3000e-004**	**5.7000e-004**	**5.8900e-003**	**1.0000e-005**	**1.1100e-003**	**1.0000e-005**	**1.1200e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0343**	**1.0343**	**6.0000e-005**	**0.0000**	**1.0355**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.8900e-003	1.0000e-005	1.1100e-003	1.0000e-005	1.1200e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0343	1.0343	6.0000e-005	0.0000	1.0355
Total	**3.3000e-004**	**5.7000e-004**	**5.8900e-003**	**1.0000e-005**	**1.1100e-003**	**1.0000e-005**	**1.1200e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0343**	**1.0343**	**6.0000e-005**	**0.0000**	**1.0355**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.8900e-003	1.0000e-005	1.1100e-003	1.0000e-005	1.1200e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0343	1.0343	6.0000e-005	0.0000	1.0355
Total	**3.3000e-004**	**5.7000e-004**	**5.8900e-003**	**1.0000e-005**	**1.1100e-003**	**1.0000e-005**	**1.1200e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0343**	**1.0343**	**6.0000e-005**	**0.0000**	**1.0355**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.8900e-003	1.0000e-005	1.1100e-003	1.0000e-005	1.1200e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0343	1.0343	6.0000e-005	0.0000	1.0355
Total	**3.3000e-004**	**5.7000e-004**	**5.8900e-003**	**1.0000e-005**	**1.1100e-003**	**1.0000e-005**	**1.1200e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0343**	**1.0343**	**6.0000e-005**	**0.0000**	**1.0355**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Unmitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247

Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564

Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326

Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071

Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	385.8858	22.8052	0.0000	864.7950
Unmitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689

General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411

Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Site Preparation, Grading & Paving

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Restoring CalEEMod Defaults since some equipment was entered with different unit amount and hours to account for unit fractions.

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Grading -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40

tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	2.6351	31.6828	21.2657	0.0573	2.5527	1.2752	3.8280	0.5147	1.1731	1.6879	0.0000	5,840.0369	5,840.0369	0.2959	0.0000	5,846.2512
2016	22.6180	266.2605	161.6808	0.2268	27.0635	11.8528	38.9163	9.7094	10.9046	20.6140	0.0000	23,357.9178	23,357.9178	6.8090	0.0000	23,500.9065
2017	4.0843	18.5537	11.8485	0.0162	0.1505	1.2180	1.3685	0.0399	1.1205	1.1604	0.0000	1,621.0991	1,621.0991	0.4563	0.0000	1,630.6824
Total	**29.3375**	**316.4971**	**194.7950**	**0.3004**	**29.7668**	**14.3460**	**44.1127**	**10.2641**	**13.1982**	**23.4623**	**0.0000**	**30,819.0538**	**30,819.0538**	**7.5612**	**0.0000**	**30,977.8400**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	2.6351	31.6828	21.2657	0.0573	1.9058	1.2752	3.1811	0.4449	1.1731	1.6180	0.0000	5,840.0369	5,840.0369	0.2959	0.0000	5,846.2512
2016	22.6180	266.2605	161.6808	0.2268	11.0873	11.8528	22.9401	3.9279	10.9046	14.8325	0.0000	23,357.9178	23,357.9178	6.8090	0.0000	23,500.9064
2017	4.0843	18.5537	11.8485	0.0162	0.1505	1.2180	1.3685	0.0399	1.1205	1.1604	0.0000	1,621.0991	1,621.0991	0.4563	0.0000	1,630.6824
Total	**29.3375**	**316.4971**	**194.7950**	**0.3004**	**13.1437**	**14.3460**	**27.4896**	**4.4127**	**13.1982**	**17.6109**	**0.0000**	**30,819.0538**	**30,819.0538**	**7.5612**	**0.0000**	**30,977.8399**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**55.84**	**0.00**	**37.68**	**57.01**	**0.00**	**24.94**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor

Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	8.00	0.00	1,920.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	58.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving2	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642		832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**1.0605**	**0.9393**	**1.9998**	**0.1145**	**0.8642**	**0.9787**		**832.7380**	**832.7380**	**0.2486**		**837.9588**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.2809	20.3068	13.8435	0.0479	1.3718	0.3348	1.7066	0.3683	0.3079	0.6762		4,870.9867	4,870.9867	0.0396		4,871.8184
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0451	0.0653	0.8054	1.5600e-003	0.1204	1.1800e-003	0.1216	0.0319	1.0800e-003	0.0330		136.3121	136.3121	7.7100e-003		136.4740
Total	**1.3260**	**20.3721**	**14.6489**	**0.0494**	**1.4922**	**0.3359**	**1.8282**	**0.4002**	**0.3090**	**0.7092**		**5,007.2989**	**5,007.2989**	**0.0473**		**5,008.2924**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642	0.0000	832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**0.4136**	**0.9393**	**1.3529**	**0.0447**	**0.8642**	**0.9088**	**0.0000**	**832.7380**	**832.7380**	**0.2486**		**837.9588**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.2809	20.3068	13.8435	0.0479	1.3718	0.3348	1.7066	0.3683	0.3079	0.6762		4,870.9867	4,870.9867	0.0396		4,871.8184
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0451	0.0653	0.8054	1.5600e-003	0.1204	1.1800e-003	0.1216	0.0319	1.0800e-003	0.0330		136.3121	136.3121	7.7100e-003		136.4740
Total	**1.3260**	**20.3721**	**14.6489**	**0.0494**	**1.4922**	**0.3359**	**1.8282**	**0.4002**	**0.3090**	**0.7092**		**5,007.2989**	**5,007.2989**	**0.0473**		**5,008.2924**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421		823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**1.0605**	**0.9153**	**1.9758**	**0.1145**	**0.8421**	**0.9566**		**823.5941**	**823.5941**	**0.2484**		**828.8110**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1273	17.9405	12.7314	0.0478	3.8947	0.2656	4.1604	0.9876	0.2443	1.2319		4,817.1802	4,817.1802	0.0356		4,817.9282
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0405	0.0591	0.7308	1.5600e-003	0.1204	1.1200e-003	0.1215	0.0319	1.0300e-003	0.0330		131.7650	131.7650	7.1100e-003		131.9144
Total	**1.1678**	**17.9996**	**13.4622**	**0.0494**	**4.0151**	**0.2668**	**4.2819**	**1.0195**	**0.2454**	**1.2649**		**4,948.9452**	**4,948.9452**	**0.0427**		**4,949.8426**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421	0.0000	823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**0.4136**	**0.9153**	**1.3289**	**0.0447**	**0.8421**	**0.8867**	**0.0000**	**823.5941**	**823.5941**	**0.2484**		**828.8110**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1273	17.9405	12.7314	0.0478	3.8947	0.2656	4.1604	0.9876	0.2443	1.2319		4,817.1802	4,817.1802	0.0356		4,817.9282
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0405	0.0591	0.7308	1.5600e-003	0.1204	1.1200e-003	0.1215	0.0319	1.0300e-003	0.0330		131.7650	131.7650	7.1100e-003		131.9144
Total	**1.1678**	**17.9996**	**13.4622**	**0.0494**	**4.0151**	**0.2668**	**4.2819**	**1.0195**	**0.2454**	**1.2649**		**4,948.9452**	**4,948.9452**	**0.0427**		**4,949.8426**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					26.1905	0.0000	26.1905	9.4779	0.0000	9.4779			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971		22,402.6214	22,402.6214	6.7574		22,544.5274
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**26.1905**	**11.8447**	**38.0352**	**9.4779**	**10.8971**	**20.3751**		**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5274**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2936	0.4281	5.2980	0.0113	0.8730	8.0900e-003	0.8811	0.2315	7.4400e-003	0.2389		955.2964	955.2964	0.0516		956.3791
Total	**0.2936**	**0.4281**	**5.2980**	**0.0113**	**0.8730**	**8.0900e-003**	**0.8811**	**0.2315**	**7.4400e-003**	**0.2389**		**955.2964**	**955.2964**	**0.0516**		**956.3791**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					10.2143	0.0000	10.2143	3.6964	0.0000	3.6964			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971	0.0000	22,402.6214	22,402.6214	6.7574		22,544.5273
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**10.2143**	**11.8447**	**22.0590**	**3.6964**	**10.8971**	**14.5935**	**0.0000**	**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5273**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2936	0.4281	5.2980	0.0113	0.8730	8.0900e-003	0.8811	0.2315	7.4400e-003	0.2389		955.2964	955.2964	0.0516		956.3791

Total	**0.2936**	**0.4281**	**5.2980**	**0.0113**	**0.8730**	**8.0900e-003**	**0.8811**	**0.2315**	**7.4400e-003**	**0.2389**		**955.2964**	**955.2964**	**0.0516**		**956.3791**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0452	0.0668	0.8277	1.9500e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		158.5416	158.5416	8.2200e-003		158.7142
Total	**0.0452**	**0.0668**	**0.8277**	**1.9500e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**158.5416**	**158.5416**	**8.2200e-003**		**158.7142**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0452	0.0668	0.8277	1.9500e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		158.5416	158.5416	8.2200e-003		158.7142
Total	**0.0452**	**0.0668**	**0.8277**	**1.9500e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**158.5416**	**158.5416**	**8.2200e-003**		**158.7142**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0452	0.0668	0.8277	1.9500e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		158.5416	158.5416	8.2200e-003		158.7142
Total	**0.0452**	**0.0668**	**0.8277**	**1.9500e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**158.5416**	**158.5416**	**8.2200e-003**		**158.7142**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0452	0.0668	0.8277	1.9500e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		158.5416	158.5416	8.2200e-003		158.7142
Total	**0.0452**	**0.0668**	**0.8277**	**1.9500e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**158.5416**	**158.5416**	**8.2200e-003**		**158.7142**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Unmitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT

City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Site Preparation, Grading & Paving

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Restoring CalEEMod Defaults since some equipment was entered with different unit amount and hours to account for unit fractions.

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Grading -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40

tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	1,920.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	2.7170	32.4051	23.2361	0.0572	2.5527	1.2764	3.8291	0.5147	1.1742	1.6890	0.0000	5,820.9628	5,820.9628	0.2964	0.0000	5,827.1871
2016	22.6270	266.3073	161.3151	0.2262	27.0635	11.8528	38.9163	9.7094	10.9046	20.6140	0.0000	23,304.1148	23,304.1148	6.8090	0.0000	23,447.1034
2017	4.0856	18.5610	11.7881	0.0161	0.1505	1.2180	1.3685	0.0399	1.1205	1.1604	0.0000	1,612.1586	1,612.1586	0.4563	0.0000	1,621.7419
Total	**29.4296**	**317.2733**	**196.3393**	**0.2995**	**29.7668**	**14.3472**	**44.1139**	**10.2641**	**13.1993**	**23.4634**	**0.0000**	**30,737.2363**	**30,737.2363**	**7.5617**	**0.0000**	**30,896.0324**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	2.7170	32.4051	23.2361	0.0572	1.9058	1.2764	3.1822	0.4449	1.1742	1.6191	0.0000	5,820.9628	5,820.9628	0.2964	0.0000	5,827.1871
2016	22.6270	266.3073	161.3151	0.2262	11.0873	11.8528	22.9401	3.9279	10.9046	14.8325	0.0000	23,304.1148	23,304.1148	6.8090	0.0000	23,447.1034
2017	4.0856	18.5610	11.7881	0.0161	0.1505	1.2180	1.3685	0.0399	1.1205	1.1604	0.0000	1,612.1586	1,612.1586	0.4563	0.0000	1,621.7419
Total	**29.4296**	**317.2733**	**196.3393**	**0.2995**	**13.1437**	**14.3472**	**27.4908**	**4.4127**	**13.1993**	**17.6120**	**0.0000**	**30,737.2362**	**30,737.2362**	**7.5617**	**0.0000**	**30,896.0323**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**55.84**	**0.00**	**37.68**	**57.01**	**0.00**	**24.94**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor

Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	8.00	0.00	1,920.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	58.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving2	4	10.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642		832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**1.0605**	**0.9393**	**1.9998**	**0.1145**	**0.8642**	**0.9787**		**832.7380**	**832.7380**	**0.2486**		**837.9588**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.3613	21.0219	15.8668	0.0478	1.3718	0.3359	1.7078	0.3683	0.3090	0.6773		4,859.5837	4,859.5837	0.0401		4,860.4254
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0466	0.0724	0.7525	1.4700e-003	0.1204	1.1800e-003	0.1216	0.0319	1.0800e-003	0.0330		128.6411	128.6411	7.7100e-003		128.8029
Total	**1.4079**	**21.0943**	**16.6193**	**0.0492**	**1.4922**	**0.3371**	**1.8294**	**0.4002**	**0.3101**	**0.7103**		**4,988.2248**	**4,988.2248**	**0.0478**		**4,989.2283**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642	0.0000	832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**0.4136**	**0.9393**	**1.3529**	**0.0447**	**0.8642**	**0.9088**	**0.0000**	**832.7380**	**832.7380**	**0.2486**		**837.9588**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.3613	21.0219	15.8668	0.0478	1.3718	0.3359	1.7078	0.3683	0.3090	0.6773		4,859.5837	4,859.5837	0.0401		4,860.4254
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0466	0.0724	0.7525	1.4700e-003	0.1204	1.1800e-003	0.1216	0.0319	1.0800e-003	0.0330		128.6411	128.6411	7.7100e-003		128.8029
Total	**1.4079**	**21.0943**	**16.6193**	**0.0492**	**1.4922**	**0.3371**	**1.8294**	**0.4002**	**0.3101**	**0.7103**		**4,988.2248**	**4,988.2248**	**0.0478**		**4,989.2283**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421		823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**1.0605**	**0.9153**	**1.9758**	**0.1145**	**0.8421**	**0.9566**		**823.5941**	**823.5941**	**0.2484**		**828.8110**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1937	18.5713	14.7564	0.0477	3.8947	0.2663	4.1610	0.9876	0.2449	1.2325		4,805.8713	4,805.8713	0.0361		4,806.6288
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0417	0.0655	0.6803	1.4700e-003	0.1204	1.1200e-003	0.1215	0.0319	1.0300e-003	0.0330		124.3439	124.3439	7.1100e-003		124.4933
Total	**1.2355**	**18.6368**	**15.4367**	**0.0492**	**4.0151**	**0.2674**	**4.2825**	**1.0195**	**0.2460**	**1.2655**		**4,930.2152**	**4,930.2152**	**0.0432**		**4,931.1221**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421	0.0000	823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**0.4136**	**0.9153**	**1.3289**	**0.0447**	**0.8421**	**0.8867**	**0.0000**	**823.5941**	**823.5941**	**0.2484**		**828.8110**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1937	18.5713	14.7564	0.0477	3.8947	0.2663	4.1610	0.9876	0.2449	1.2325		4,805.8713	4,805.8713	0.0361		4,806.6288
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0417	0.0655	0.6803	1.4700e-003	0.1204	1.1200e-003	0.1215	0.0319	1.0300e-003	0.0330		124.3439	124.3439	7.1100e-003		124.4933
Total	**1.2355**	**18.6368**	**15.4367**	**0.0492**	**4.0151**	**0.2674**	**4.2825**	**1.0195**	**0.2460**	**1.2655**		**4,930.2152**	**4,930.2152**	**0.0432**		**4,931.1221**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					26.1905	0.0000	26.1905	9.4779	0.0000	9.4779			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971		22,402.6214	22,402.6214	6.7574		22,544.5274
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**26.1905**	**11.8447**	**38.0352**	**9.4779**	**10.8971**	**20.3751**		**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5274**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3027	0.4749	4.9323	0.0107	0.8730	8.0900e-003	0.8811	0.2315	7.4400e-003	0.2389		901.4934	901.4934	0.0516		902.5761
Total	**0.3027**	**0.4749**	**4.9323**	**0.0107**	**0.8730**	**8.0900e-003**	**0.8811**	**0.2315**	**7.4400e-003**	**0.2389**		**901.4934**	**901.4934**	**0.0516**		**902.5761**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					10.2143	0.0000	10.2143	3.6964	0.0000	3.6964			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971	0.0000	22,402.6214	22,402.6214	6.7574		22,544.5273
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**10.2143**	**11.8447**	**22.0590**	**3.6964**	**10.8971**	**14.5935**	**0.0000**	**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5273**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3027	0.4749	4.9323	0.0107	0.8730	8.0900e-003	0.8811	0.2315	7.4400e-003	0.2389		901.4934	901.4934	0.0516		902.5761

Total	**0.3027**	**0.4749**	**4.9323**	**0.0107**	**0.8730**	**8.0900e-003**	**0.8811**	**0.2315**	**7.4400e-003**	**0.2389**		**901.4934**	**901.4934**	**0.0516**		**902.5761**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0465	0.0741	0.7673	1.8400e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		149.6011	149.6011	8.2200e-003		149.7737
Total	**0.0465**	**0.0741**	**0.7673**	**1.8400e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**149.6011**	**149.6011**	**8.2200e-003**		**149.7737**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0465	0.0741	0.7673	1.8400e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		149.6011	149.6011	8.2200e-003		149.7737
Total	**0.0465**	**0.0741**	**0.7673**	**1.8400e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**149.6011**	**149.6011**	**8.2200e-003**		**149.7737**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					

Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0465	0.0741	0.7673	1.8400e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		149.6011	149.6011	8.2200e-003		149.7737
Total	**0.0465**	**0.0741**	**0.7673**	**1.8400e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**149.6011**	**149.6011**	**8.2200e-003**		**149.7737**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0465	0.0741	0.7673	1.8400e-003	0.1505	1.3400e-003	0.1519	0.0399	1.2300e-003	0.0412		149.6011	149.6011	8.2200e-003		149.7737
Total	**0.0465**	**0.0741**	**0.7673**	**1.8400e-003**	**0.1505**	**1.3400e-003**	**0.1519**	**0.0399**	**1.2300e-003**	**0.0412**		**149.6011**	**149.6011**	**8.2200e-003**		**149.7737**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Unmitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT

City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT -

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	1,979.00
tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.0659	0.7170	0.4954	8.5000e-004	7.1900e-003	0.0378	0.0450	1.9100e-003	0.0348	0.0367	0.0000	78.1088	78.1088	0.0219	0.0000	78.5676
2017	0.3209	2.9240	2.0563	3.2200e-003	0.0101	0.1830	0.1931	2.6700e-003	0.1710	0.1737	0.0000	289.4041	289.4041	0.0753	0.0000	290.9860
2018	0.3483	3.0355	2.2880	3.5000e-003	0.0000	0.1950	0.1950	0.0000	0.1833	0.1833	0.0000	308.9844	308.9844	0.0756	0.0000	310.5723
2019	0.3069	2.7359	2.2342	3.5000e-003	0.0000	0.1677	0.1677	0.0000	0.1577	0.1577	0.0000	305.5302	305.5302	0.0743	0.0000	307.0913
2020	0.2766	2.5000	2.2019	3.5100e-003	0.0000	0.1458	0.1458	0.0000	0.1371	0.1371	0.0000	302.1514	302.1514	0.0736	0.0000	303.6973
2021	0.2471	2.2629	2.1582	3.5000e-003	0.0000	0.1246	0.1246	0.0000	0.1172	0.1172	0.0000	301.0339	301.0339	0.0725	0.0000	302.5568
2022	0.2209	2.0197	2.1226	3.4900e-003	0.0000	0.1047	0.1047	0.0000	0.0986	0.0986	0.0000	299.9946	299.9946	0.0718	0.0000	301.5017
2023	0.2036	1.8606	2.1072	3.4900e-003	0.0000	0.0906	0.0906	0.0000	0.0852	0.0852	0.0000	300.0980	300.0980	0.0713	0.0000	301.5949
2024	0.1920	1.7524	2.1135	3.5200e-003	0.0000	0.0800	0.0800	0.0000	0.0752	0.0752	0.0000	302.4646	302.4646	0.0714	0.0000	303.9643
Total	**2.1820**	**19.8082**	**17.7772**	**0.0286**	**0.0173**	**1.1292**	**1.1465**	**4.5800e-003**	**1.0601**	**1.0646**	**0.0000**	**2,487.7700**	**2,487.7700**	**0.6077**	**0.0000**	**2,500.5322**

2.1 Overall Construction

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.0659	0.7170	0.4954	8.5000e-004	7.1900e-003	0.0378	0.0450	1.9100e-003	0.0348	0.0367	0.0000	78.1088	78.1088	0.0219	0.0000	78.5675
2017	0.3209	2.9240	2.0563	3.2200e-003	0.0101	0.1830	0.1931	2.6700e-003	0.1710	0.1737	0.0000	289.4038	289.4038	0.0753	0.0000	290.9857
2018	0.3483	3.0355	2.2880	3.5000e-003	0.0000	0.1950	0.1950	0.0000	0.1833	0.1833	0.0000	308.9841	308.9841	0.0756	0.0000	310.5720
2019	0.3069	2.7359	2.2342	3.5000e-003	0.0000	0.1677	0.1677	0.0000	0.1577	0.1577	0.0000	305.5299	305.5299	0.0743	0.0000	307.0909
2020	0.2766	2.5000	2.2019	3.5100e-003	0.0000	0.1458	0.1458	0.0000	0.1371	0.1371	0.0000	302.1510	302.1510	0.0736	0.0000	303.6969
2021	0.2471	2.2629	2.1582	3.5000e-003	0.0000	0.1246	0.1246	0.0000	0.1172	0.1172	0.0000	301.0335	301.0335	0.0725	0.0000	302.5565
2022	0.2209	2.0197	2.1226	3.4900e-003	0.0000	0.1047	0.1047	0.0000	0.0986	0.0986	0.0000	299.9943	299.9943	0.0718	0.0000	301.5013
2023	0.2036	1.8606	2.1072	3.4900e-003	0.0000	0.0906	0.0906	0.0000	0.0852	0.0852	0.0000	300.0976	300.0976	0.0713	0.0000	301.5946
2024	0.1920	1.7524	2.1135	3.5200e-003	0.0000	0.0800	0.0800	0.0000	0.0752	0.0752	0.0000	302.4642	302.4642	0.0714	0.0000	303.9639
Total	**2.1820**	**19.8082**	**17.7772**	**0.0286**	**0.0173**	**1.1292**	**1.1465**	**4.5800e-003**	**1.0601**	**1.0646**	**0.0000**	**2,487.7671**	**2,487.7671**	**0.6077**	**0.0000**	**2,500.5293**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6438**	**0.2703**	**50,832.7470**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6426**	**0.2701**	**50,832.6439**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0635	0.7129	0.4530	7.5000e-004		0.0377	0.0377		0.0347	0.0347	0.0000	71.1240	71.1240	0.0215	0.0000	71.5745
Total	**0.0635**	**0.7129**	**0.4530**	**7.5000e-004**		**0.0377**	**0.0377**		**0.0347**	**0.0347**	**0.0000**	**71.1240**	**71.1240**	**0.0215**	**0.0000**	**71.5745**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4200e-003	4.1000e-003	0.0424	9.0000e-005	7.1900e-003	7.0000e-005	7.2600e-003	1.9100e-003	6.0000e-005	1.9700e-003	0.0000	6.9848	6.9848	3.9000e-004	0.0000	6.9931
Total	**2.4200e-003**	**4.1000e-003**	**0.0424**	**9.0000e-005**	**7.1900e-003**	**7.0000e-005**	**7.2600e-003**	**1.9100e-003**	**6.0000e-005**	**1.9700e-003**	**0.0000**	**6.9848**	**6.9848**	**3.9000e-004**	**0.0000**	**6.9931**

3.2 Utility Installation - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0635	0.7129	0.4530	7.5000e-004		0.0377	0.0377		0.0347	0.0347	0.0000	71.1239	71.1239	0.0215	0.0000	71.5745
Total	**0.0635**	**0.7129**	**0.4530**	**7.5000e-004**		**0.0377**	**0.0377**		**0.0347**	**0.0347**	**0.0000**	**71.1239**	**71.1239**	**0.0215**	**0.0000**	**71.5745**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4200e-003	4.1000e-003	0.0424	9.0000e-005	7.1900e-003	7.0000e-005	7.2600e-003	1.9100e-003	6.0000e-005	1.9700e-003	0.0000	6.9848	6.9848	3.9000e-004	0.0000	6.9931
Total	**2.4200e-003**	**4.1000e-003**	**0.0424**	**9.0000e-005**	**7.1900e-003**	**7.0000e-005**	**7.2600e-003**	**1.9100e-003**	**6.0000e-005**	**1.9700e-003**	**0.0000**	**6.9848**	**6.9848**	**3.9000e-004**	**0.0000**	**6.9931**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0822	0.9120	0.6248	1.0600e-003		0.0476	0.0476		0.0438	0.0438	0.0000	97.9878	97.9878	0.0300	0.0000	98.6183
Total	**0.0822**	**0.9120**	**0.6248**	**1.0600e-003**		**0.0476**	**0.0476**		**0.0438**	**0.0438**	**0.0000**	**97.9878**	**97.9878**	**0.0300**	**0.0000**	**98.6183**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0100e-003	5.1900e-003	0.0536	1.3000e-004	0.0101	9.0000e-005	0.0102	2.6700e-003	8.0000e-005	2.7600e-003	0.0000	9.4122	9.4122	5.1000e-004	0.0000	9.4229
Total	**3.0100e-003**	**5.1900e-003**	**0.0536**	**1.3000e-004**	**0.0101**	**9.0000e-005**	**0.0102**	**2.6700e-003**	**8.0000e-005**	**2.7600e-003**	**0.0000**	**9.4122**	**9.4122**	**5.1000e-004**	**0.0000**	**9.4229**

3.2 Utility Installation - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0821	0.9120	0.6248	1.0600e-003		0.0476	0.0476		0.0438	0.0438	0.0000	97.9877	97.9877	0.0300	0.0000	98.6182
Total	**0.0821**	**0.9120**	**0.6248**	**1.0600e-003**		**0.0476**	**0.0476**		**0.0438**	**0.0438**	**0.0000**	**97.9877**	**97.9877**	**0.0300**	**0.0000**	**98.6182**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0100e-003	5.1900e-003	0.0536	1.3000e-004	0.0101	9.0000e-005	0.0102	2.6700e-003	8.0000e-005	2.7600e-003	0.0000	9.4122	9.4122	5.1000e-004	0.0000	9.4229
Total	**3.0100e-003**	**5.1900e-003**	**0.0536**	**1.3000e-004**	**0.0101**	**9.0000e-005**	**0.0102**	**2.6700e-003**	**8.0000e-005**	**2.7600e-003**	**0.0000**	**9.4122**	**9.4122**	**5.1000e-004**	**0.0000**	**9.4229**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2358	2.0068	1.3778	2.0400e-003		0.1354	0.1354		0.1272	0.1272	0.0000	182.0041	182.0041	0.0448	0.0000	182.9448
Total	**0.2358**	**2.0068**	**1.3778**	**2.0400e-003**		**0.1354**	**0.1354**		**0.1272**	**0.1272**	**0.0000**	**182.0041**	**182.0041**	**0.0448**	**0.0000**	**182.9448**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2358	2.0068	1.3778	2.0400e-003		0.1354	0.1354		0.1272	0.1272	0.0000	182.0039	182.0039	0.0448	0.0000	182.9446
Total	**0.2358**	**2.0068**	**1.3778**	**2.0400e-003**		**0.1354**	**0.1354**		**0.1272**	**0.1272**	**0.0000**	**182.0039**	**182.0039**	**0.0448**	**0.0000**	**182.9446**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9844	308.9844	0.0756	0.0000	310.5723
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9844**	**308.9844**	**0.0756**	**0.0000**	**310.5723**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9841	308.9841	0.0756	0.0000	310.5720
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9841**	**308.9841**	**0.0756**	**0.0000**	**310.5720**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5302	305.5302	0.0743	0.0000	307.0913
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5302**	**305.5302**	**0.0743**	**0.0000**	**307.0913**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5299	305.5299	0.0743	0.0000	307.0909
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5299**	**305.5299**	**0.0743**	**0.0000**	**307.0909**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1514	302.1514	0.0736	0.0000	303.6973
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1514**	**302.1514**	**0.0736**	**0.0000**	**303.6973**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1510	302.1510	0.0736	0.0000	303.6969
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1510**	**302.1510**	**0.0736**	**0.0000**	**303.6969**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0339	301.0339	0.0725	0.0000	302.5568
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0339**	**301.0339**	**0.0725**	**0.0000**	**302.5568**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0335	301.0335	0.0725	0.0000	302.5565
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0335**	**301.0335**	**0.0725**	**0.0000**	**302.5565**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9946	299.9946	0.0718	0.0000	301.5017
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9946**	**299.9946**	**0.0718**	**0.0000**	**301.5017**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9943	299.9943	0.0718	0.0000	301.5013
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9943**	**299.9943**	**0.0718**	**0.0000**	**301.5013**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2036	1.8606	2.1072	3.4900e-003		0.0906	0.0906		0.0852	0.0852	0.0000	300.0980	300.0980	0.0713	0.0000	301.5949
Total	**0.2036**	**1.8606**	**2.1072**	**3.4900e-003**		**0.0906**	**0.0906**		**0.0852**	**0.0852**	**0.0000**	**300.0980**	**300.0980**	**0.0713**	**0.0000**	**301.5949**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2036	1.8606	2.1072	3.4900e-003		0.0906	0.0906		0.0852	0.0852	0.0000	300.0976	300.0976	0.0713	0.0000	301.5946
Total	**0.2036**	**1.8606**	**2.1072**	**3.4900e-003**		**0.0906**	**0.0906**		**0.0852**	**0.0852**	**0.0000**	**300.0976**	**300.0976**	**0.0713**	**0.0000**	**301.5946**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1920	1.7524	2.1135	3.5200e-003		0.0800	0.0800		0.0752	0.0752	0.0000	302.4646	302.4646	0.0714	0.0000	303.9643
Total	**0.1920**	**1.7524**	**2.1135**	**3.5200e-003**		**0.0800**	**0.0800**		**0.0752**	**0.0752**	**0.0000**	**302.4646**	**302.4646**	**0.0714**	**0.0000**	**303.9643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1920	1.7524	2.1135	3.5200e-003		0.0800	0.0800		0.0752	0.0752	0.0000	302.4642	302.4642	0.0714	0.0000	303.9639
Total	**0.1920**	**1.7524**	**2.1135**	**3.5200e-003**		**0.0800**	**0.0800**		**0.0752**	**0.0752**	**0.0000**	**302.4642**	**302.4642**	**0.0714**	**0.0000**	**303.9639**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Unmitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	385.8858	22.8052	0.0000	864.7950
Unmitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT -

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	1,979.00
tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7581	19.1065	13.2672	0.0227	0.1957	1.0079	1.2036	0.0519	0.9272	0.9791	0.0000	2,304.8064	2,304.8064	0.6422	0.0000	2,318.2922
2017	3.1024	26.4057	18.1291	0.0268	0.1957	1.7812	1.7812	0.0519	1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9390	2,609.9390	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.6157**	**169.3887**	**148.0655**	**0.2372**	**0.3914**	**9.7491**	**9.9448**	**0.1038**	**9.1457**	**9.1976**	**0.0000**	**22,854.0654**	**22,854.0654**	**5.6044**	**0.0000**	**22,971.7577**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7581	19.1065	13.2672	0.0227	0.1957	1.0079	1.2036	0.0519	0.9272	0.9791	0.0000	2,304.8064	2,304.8064	0.6422	0.0000	2,318.2922
2017	3.1024	26.4057	18.1291	0.0268	0.1957	1.7812	1.7812	0.0519	1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.6157**	**169.3887**	**148.0655**	**0.2372**	**0.3914**	**9.7491**	**9.9448**	**0.1038**	**9.1457**	**9.1976**	**0.0000**	**22,854.0654**	**22,854.0654**	**5.6044**	**0.0000**	**22,971.7577**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256		2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**		**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0658	0.0960	1.1875	2.5300e-003	0.1957	1.8100e-003	0.1975	0.0519	1.6700e-003	0.0536		214.1182	214.1182	0.0116		214.3608
Total	**0.0658**	**0.0960**	**1.1875**	**2.5300e-003**	**0.1957**	**1.8100e-003**	**0.1975**	**0.0519**	**1.6700e-003**	**0.0536**		**214.1182**	**214.1182**	**0.0116**		**214.3608**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256	0.0000	2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**	**0.0000**	**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0658	0.0960	1.1875	2.5300e-003	0.1957	1.8100e-003	0.1975	0.0519	1.6700e-003	0.0536		214.1182	214.1182	0.0116		214.3608
Total	**0.0658**	**0.0960**	**1.1875**	**2.5300e-003**	**0.1957**	**1.8100e-003**	**0.1975**	**0.0519**	**1.6700e-003**	**0.0536**		**214.1182**	**214.1182**	**0.0116**		**214.3608**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336		2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**		**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0587	0.0868	1.0760	2.5300e-003	0.1957	1.7400e-003	0.1974	0.0519	1.6000e-003	0.0535		206.1041	206.1041	0.0107		206.3285
Total	**0.0587**	**0.0868**	**1.0760**	**2.5300e-003**	**0.1957**	**1.7400e-003**	**0.1974**	**0.0519**	**1.6000e-003**	**0.0535**		**206.1041**	**206.1041**	**0.0107**		**206.3285**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336	0.0000	2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**	**0.0000**	**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0587	0.0868	1.0760	2.5300e-003	0.1957	1.7400e-003	0.1974	0.0519	1.6000e-003	0.0535		206.1041	206.1041	0.0107		206.3285
Total	**0.0587**	**0.0868**	**1.0760**	**2.5300e-003**	**0.1957**	**1.7400e-003**	**0.1974**	**0.0519**	**1.6000e-003**	**0.0535**		**206.1041**	**206.1041**	**0.0107**		**206.3285**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730		2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**		**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**	**0.0000**	**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048		2,609.9390	2,609.9390	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**		**2,609.9390**	**2,609.9390**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**	**0.0000**	**2,609.9389**	**2,609.9389**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979		2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**		**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**	**0.0000**	**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581		2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**		**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**	**0.0000**	**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557		2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**		**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**	**0.0000**	**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744		2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**		**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**	**0.0000**	**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Unmitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT -

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	1,979.00
tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7601	19.1170	13.1852	0.0225	0.1957	1.0079	1.2036	0.0519	0.9272	0.9791	0.0000	2,292.7471	2,292.7471	0.6422	0.0000	2,306.2330
2017	3.1024	26.4057	18.1291	0.0268	0.1957	1.7812	1.7812	0.0519	1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9390	2,609.9390	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.6177**	**169.3992**	**147.9835**	**0.2370**	**0.3914**	**9.7491**	**9.9448**	**0.1038**	**9.1457**	**9.1976**	**0.0000**	**22,842.0062**	**22,842.0062**	**5.6044**	**0.0000**	**22,959.6984**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7601	19.1170	13.1852	0.0225	0.1957	1.0079	1.2036	0.0519	0.9272	0.9791	0.0000	2,292.7471	2,292.7471	0.6422	0.0000	2,306.2330
2017	3.1024	26.4057	18.1291	0.0268	0.1957	1.7812	1.7812	0.0519	1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.6177**	**169.3992**	**147.9835**	**0.2370**	**0.3914**	**9.7491**	**9.9448**	**0.1038**	**9.1457**	**9.1976**	**0.0000**	**22,842.0061**	**22,842.0061**	**5.6044**	**0.0000**	**22,959.6984**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256		2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**		**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0678	0.1064	1.1055	2.3900e-003	0.1957	1.8100e-003	0.1975	0.0519	1.6700e-003	0.0536		202.0589	202.0589	0.0116		202.3015
Total	**0.0678**	**0.1064**	**1.1055**	**2.3900e-003**	**0.1957**	**1.8100e-003**	**0.1975**	**0.0519**	**1.6700e-003**	**0.0536**		**202.0589**	**202.0589**	**0.0116**		**202.3015**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256	0.0000	2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**	**0.0000**	**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0678	0.1064	1.1055	2.3900e-003	0.1957	1.8100e-003	0.1975	0.0519	1.6700e-003	0.0536		202.0589	202.0589	0.0116		202.3015
Total	**0.0678**	**0.1064**	**1.1055**	**2.3900e-003**	**0.1957**	**1.8100e-003**	**0.1975**	**0.0519**	**1.6700e-003**	**0.0536**		**202.0589**	**202.0589**	**0.0116**		**202.3015**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336		2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**		**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0604	0.0963	0.9974	2.3900e-003	0.1957	1.7400e-003	0.1974	0.0519	1.6000e-003	0.0535		194.4815	194.4815	0.0107		194.7059
Total	**0.0604**	**0.0963**	**0.9974**	**2.3900e-003**	**0.1957**	**1.7400e-003**	**0.1974**	**0.0519**	**1.6000e-003**	**0.0535**		**194.4815**	**194.4815**	**0.0107**		**194.7059**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336	0.0000	2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**	**0.0000**	**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0604	0.0963	0.9974	2.3900e-003	0.1957	1.7400e-003	0.1974	0.0519	1.6000e-003	0.0535		194.4815	194.4815	0.0107		194.7059
Total	**0.0604**	**0.0963**	**0.9974**	**2.3900e-003**	**0.1957**	**1.7400e-003**	**0.1974**	**0.0519**	**1.6000e-003**	**0.0535**		**194.4815**	**194.4815**	**0.0107**		**194.7059**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730		2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**		**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**	**0.0000**	**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048		2,609.9390	2,609.9390	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**		**2,609.9390**	**2,609.9390**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**	**0.0000**	**2,609.9389**	**2,609.9389**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979		2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**		**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**	**0.0000**	**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581		2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**		**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**	**0.0000**	**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557		2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**		**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**	**0.0000**	**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744		2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**		**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**	**0.0000**	**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Unmitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Trips and VMT - From yearly analysis

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	152.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	260.00

tblConstructionPhase	NumDays	4,650.00	260.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	PhaseEndDate	12/29/2017	12/31/2017
tblConstructionPhase	PhaseStartDate	12/31/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	12/30/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	110.00
tblTripsAndVMT	VendorTripNumber	419.00	222.00
tblTripsAndVMT	VendorTripNumber	419.00	26.00
tblTripsAndVMT	VendorTripNumber	419.00	10.00
tblTripsAndVMT	VendorTripNumber	419.00	6.00
tblTripsAndVMT	VendorTripNumber	419.00	11.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	385.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	651.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	172.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	64.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	43.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	72.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.0873	0.3518	1.4575	3.3900e-003	0.2357	5.5700e-003	0.2413	0.0630	5.1300e-003	0.0681	0.0000	260.7174	260.7174	0.0114	0.0000	260.9569
2018	0.1354	0.5526	2.2940	5.8200e-003	0.4048	9.1000e-003	0.4138	0.1081	8.3800e-003	0.1165	0.0000	433.2546	433.2546	0.0183	0.0000	433.6378
2019	0.2902	1.4438	4.8159	0.0129	0.8422	0.0242	0.8665	0.2257	0.0223	0.2480	0.0000	948.3792	948.3792	0.0348	0.0000	949.1097
2020	0.4990	2.4910	8.2105	0.0230	1.4627	0.0438	1.5065	0.3925	0.0403	0.4328	0.0000	1,653.0307	1,653.0307	0.0568	0.0000	1,654.2239
2021	0.0949	0.3202	1.6236	5.0100e-003	0.3551	6.3000e-003	0.3614	0.0948	5.8200e-003	0.1006	0.0000	341.5850	341.5850	0.0137	0.0000	341.8730
2022	0.0338	0.1112	0.5736	1.8700e-003	0.1319	2.3600e-003	0.1343	0.0352	2.1800e-003	0.0374	0.0000	125.8054	125.8054	4.8900e-003	0.0000	125.9080
2023	0.0207	0.0594	0.3551	1.2300e-003	0.0880	1.4800e-003	0.0894	0.0235	1.3600e-003	0.0248	0.0000	81.4653	81.4653	3.1300e-003	0.0000	81.5310
2024	0.0343	0.1025	0.5842	2.1200e-003	0.1493	2.6300e-003	0.1519	0.0399	2.4300e-003	0.0423	0.0000	139.3077	139.3077	5.1700e-003	0.0000	139.4162
Total	**1.1956**	**5.4324**	**19.9145**	**0.0553**	**3.6697**	**0.0954**	**3.7651**	**0.9825**	**0.0880**	**1.0704**	**0.0000**	**3,983.5452**	**3,983.5452**	**0.1482**	**0.0000**	**3,986.6566**

2.1 Overall Construction

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.0873	0.3518	1.4575	3.3900e-003	0.2357	5.5700e-003	0.2413	0.0630	5.1300e-003	0.0681	0.0000	260.7174	260.7174	0.0114	0.0000	260.9569
2018	0.1354	0.5526	2.2940	5.8200e-003	0.4048	9.1000e-003	0.4138	0.1081	8.3800e-003	0.1165	0.0000	433.2546	433.2546	0.0183	0.0000	433.6378
2019	0.2902	1.4438	4.8159	0.0129	0.8422	0.0242	0.8665	0.2257	0.0223	0.2480	0.0000	948.3792	948.3792	0.0348	0.0000	949.1097
2020	0.4990	2.4910	8.2105	0.0230	1.4627	0.0438	1.5065	0.3925	0.0403	0.4328	0.0000	1,653.0307	1,653.0307	0.0568	0.0000	1,654.2239
2021	0.0949	0.3202	1.6236	5.0100e-003	0.3551	6.3000e-003	0.3614	0.0948	5.8200e-003	0.1006	0.0000	341.5850	341.5850	0.0137	0.0000	341.8730
2022	0.0338	0.1112	0.5736	1.8700e-003	0.1319	2.3600e-003	0.1343	0.0352	2.1800e-003	0.0374	0.0000	125.8054	125.8054	4.8900e-003	0.0000	125.9080
2023	0.0207	0.0594	0.3551	1.2300e-003	0.0880	1.4800e-003	0.0894	0.0235	1.3600e-003	0.0248	0.0000	81.4653	81.4653	3.1300e-003	0.0000	81.5310
2024	0.0343	0.1025	0.5842	2.1200e-003	0.1493	2.6300e-003	0.1519	0.0399	2.4300e-003	0.0423	0.0000	139.3077	139.3077	5.1700e-003	0.0000	139.4162
Total	**1.1956**	**5.4324**	**19.9145**	**0.0553**	**3.6697**	**0.0954**	**3.7651**	**0.9825**	**0.0880**	**1.0704**	**0.0000**	**3,983.5452**	**3,983.5452**	**0.1482**	**0.0000**	**3,986.6566**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6438**	**0.2703**	**50,832.7470**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6426**	**0.2701**	**50,832.6439**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Building Construction 2017	Building Construction	6/1/2017	12/31/2017	5	152	
2	Building Construction 2018	Building Construction	1/1/2018	12/31/2018	5	261	
3	Building Construction 2019	Building Construction	1/1/2019	12/31/2019	5	261	
4	Building Construction 2020	Building Construction	1/1/2020	12/31/2020	5	262	
5	Building Construction 2021	Building Construction	1/1/2021	12/31/2021	5	261	
6	Builidng Construction 2022	Building Construction	1/1/2022	12/30/2022	5	260	
7	Building Construction 2023	Building Construction	1/1/2023	12/29/2023	5	260	
8	Building Construction 2024	Building Construction	1/1/2024	12/31/2024	5	262	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Building Construction 2017	Cranes	0	7.00	226	0.29
Building Construction 2018	Cranes	0	7.00	226	0.29
Building Construction 2019	Cranes	0	7.00	226	0.29
Building Construction 2020	Cranes	0	7.00	226	0.29
Building Construction 2021	Cranes	0	7.00	226	0.29
Builidng Construction 2022	Cranes	0	7.00	226	0.29
Building Construction 2023	Cranes	0	7.00	226	0.29
Building Construction 2024	Cranes	0	7.00	226	0.29

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Building Construction 2017	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2018	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2019	0	385.00	110.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2020	0	651.00	222.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2021	0	172.00	26.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Builidng Construction 2022	0	64.00	10.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2023	0	43.00	6.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2024	0	72.00	11.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Building Construction 2017 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Worker	0.0650	0.1122	1.1585	2.7500e-003	0.2176	1.9700e-003	0.2195	0.0578	1.8200e-003	0.0596	0.0000	203.3317	203.3317	0.0110	0.0000	203.5626
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0223	0.2396	0.2990	6.4000e-004	0.0181	3.6000e-003	0.0217	5.1700e-003	3.3100e-003	8.4900e-003	0.0000	57.3856	57.3856	4.1000e-004	0.0000	57.3943
Total	**0.0873**	**0.3518**	**1.4575**	**3.3900e-003**	**0.2357**	**5.5700e-003**	**0.2413**	**0.0630**	**5.1300e-003**	**0.0681**	**0.0000**	**260.7174**	**260.7174**	**0.0114**	**0.0000**	**260.9569**

3.2 Building Construction 2017 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0223	0.2396	0.2990	6.4000e-004	0.0181	3.6000e-003	0.0217	5.1700e-003	3.3100e-003	8.4900e-003	0.0000	57.3856	57.3856	4.1000e-004	0.0000	57.3943
Worker	0.0650	0.1122	1.1585	2.7500e-003	0.2176	1.9700e-003	0.2195	0.0578	1.8200e-003	0.0596	0.0000	203.3317	203.3317	0.0110	0.0000	203.5626
Total	**0.0873**	**0.3518**	**1.4575**	**3.3900e-003**	**0.2357**	**5.5700e-003**	**0.2413**	**0.0630**	**5.1300e-003**	**0.0681**	**0.0000**	**260.7174**	**260.7174**	**0.0114**	**0.0000**	**260.9569**

3.3 Building Construction 2018 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0360	0.3777	0.4926	1.1000e-003	0.0312	5.8200e-003	0.0370	8.8900e-003	5.3600e-003	0.0142	0.0000	96.9091	96.9091	7.0000e-004	0.0000	96.9239
Worker	0.0993	0.1749	1.8015	4.7200e-003	0.3736	3.2700e-003	0.3769	0.0992	3.0300e-003	0.1022	0.0000	336.3455	336.3455	0.0175	0.0000	336.7139
Total	**0.1354**	**0.5526**	**2.2940**	**5.8200e-003**	**0.4048**	**9.0900e-003**	**0.4138**	**0.1081**	**8.3900e-003**	**0.1165**	**0.0000**	**433.2546**	**433.2546**	**0.0182**	**0.0000**	**433.6378**

3.3 Building Construction 2018 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0360	0.3777	0.4926	1.1000e-003	0.0312	5.8200e-003	0.0370	8.8900e-003	5.3600e-003	0.0142	0.0000	96.9091	96.9091	7.0000e-004	0.0000	96.9239
Worker	0.0993	0.1749	1.8015	4.7200e-003	0.3736	3.2700e-003	0.3769	0.0992	3.0300e-003	0.1022	0.0000	336.3455	336.3455	0.0175	0.0000	336.7139
Total	**0.1354**	**0.5526**	**2.2940**	**5.8200e-003**	**0.4048**	**9.0900e-003**	**0.4138**	**0.1081**	**8.3900e-003**	**0.1165**	**0.0000**	**433.2546**	**433.2546**	**0.0182**	**0.0000**	**433.6378**

3.4 Building Construction 2019 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1105	1.1254	1.5401	3.5400e-003	0.1008	0.0179	0.1187	0.0288	0.0165	0.0452	0.0000	307.0823	307.0823	2.2300e-003	0.0000	307.1291
Worker	0.1797	0.3184	3.2758	9.3400e-003	0.7414	6.3200e-003	0.7477	0.1969	5.8600e-003	0.2028	0.0000	641.2970	641.2970	0.0326	0.0000	641.9806
Total	**0.2903**	**1.4438**	**4.8159**	**0.0129**	**0.8422**	**0.0242**	**0.8665**	**0.2257**	**0.0223**	**0.2480**	**0.0000**	**948.3792**	**948.3792**	**0.0348**	**0.0000**	**949.1097**

3.4 Building Construction 2019 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1105	1.1254	1.5401	3.5400e-003	0.1008	0.0179	0.1187	0.0288	0.0165	0.0452	0.0000	307.0823	307.0823	2.2300e-003	0.0000	307.1291
Worker	0.1797	0.3184	3.2758	9.3400e-003	0.7414	6.3200e-003	0.7477	0.1969	5.8600e-003	0.2028	0.0000	641.2970	641.2970	0.0326	0.0000	641.9806
Total	**0.2903**	**1.4438**	**4.8159**	**0.0129**	**0.8422**	**0.0242**	**0.8665**	**0.2257**	**0.0223**	**0.2480**	**0.0000**	**948.3792**	**948.3792**	**0.0348**	**0.0000**	**949.1097**

3.5 Building Construction 2020 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2140	1.9897	3.0330	7.1700e-003	0.2043	0.0332	0.2375	0.0583	0.0305	0.0888	0.0000	608.2542	608.2542	4.4200e-003	0.0000	608.3469
Worker	0.2850	0.5012	5.1775	0.0159	1.2584	0.0106	1.2691	0.3342	9.8400e-003	0.3440	0.0000	1,044.7765	1,044.7765	0.0524	0.0000	1,045.8770
Total	**0.4990**	**2.4910**	**8.2105**	**0.0230**	**1.4627**	**0.0438**	**1.5065**	**0.3925**	**0.0403**	**0.4328**	**0.0000**	**1,653.0307**	**1,653.0307**	**0.0568**	**0.0000**	**1,654.2239**

3.5 Building Construction 2020 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2140	1.9897	3.0330	7.1700e-003	0.2043	0.0332	0.2375	0.0583	0.0305	0.0888	0.0000	608.2542	608.2542	4.4200e-003	0.0000	608.3469
Worker	0.2850	0.5012	5.1775	0.0159	1.2584	0.0106	1.2691	0.3342	9.8400e-003	0.3440	0.0000	1,044.7765	1,044.7765	0.0524	0.0000	1,045.8770
Total	**0.4990**	**2.4910**	**8.2105**	**0.0230**	**1.4627**	**0.0438**	**1.5065**	**0.3925**	**0.0403**	**0.4328**	**0.0000**	**1,653.0307**	**1,653.0307**	**0.0568**	**0.0000**	**1,654.2239**

3.6 Building Construction 2021 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0241	0.1970	0.3445	8.4000e-004	0.0238	3.5200e-003	0.0274	6.8000e-003	3.2400e-003	0.0100	0.0000	70.9105	70.9105	5.2000e-004	0.0000	70.9213
Worker	0.0708	0.1232	1.2791	4.1800e-003	0.3312	2.7800e-003	0.3340	0.0880	2.5800e-003	0.0905	0.0000	270.6745	270.6745	0.0132	0.0000	270.9517
Total	**0.0949**	**0.3202**	**1.6236**	**5.0200e-003**	**0.3551**	**6.3000e-003**	**0.3614**	**0.0948**	**5.8200e-003**	**0.1006**	**0.0000**	**341.5850**	**341.5850**	**0.0137**	**0.0000**	**341.8730**

3.6 Building Construction 2021 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0241	0.1970	0.3445	8.4000e-004	0.0238	3.5200e-003	0.0274	6.8000e-003	3.2400e-003	0.0100	0.0000	70.9105	70.9105	5.2000e-004	0.0000	70.9213
Worker	0.0708	0.1232	1.2791	4.1800e-003	0.3312	2.7800e-003	0.3340	0.0880	2.5800e-003	0.0905	0.0000	270.6745	270.6745	0.0132	0.0000	270.9517
Total	**0.0949**	**0.3202**	**1.6236**	**5.0200e-003**	**0.3551**	**6.3000e-003**	**0.3614**	**0.0948**	**5.8200e-003**	**0.1006**	**0.0000**	**341.5850**	**341.5850**	**0.0137**	**0.0000**	**341.8730**

3.7 Builidng Construction 2022 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.0400e-003	0.0685	0.1286	3.2000e-004	9.1300e-003	1.3300e-003	0.0105	2.6000e-003	1.2300e-003	3.8300e-003	0.0000	27.1464	27.1464	2.0000e-004	0.0000	27.1506
Worker	0.0248	0.0428	0.4451	1.5500e-003	0.1228	1.0300e-003	0.1238	0.0326	9.5000e-004	0.0336	0.0000	98.6590	98.6590	4.6800e-003	0.0000	98.7574
Total	**0.0338**	**0.1112**	**0.5736**	**1.8700e-003**	**0.1319**	**2.3600e-003**	**0.1343**	**0.0352**	**2.1800e-003**	**0.0374**	**0.0000**	**125.8054**	**125.8054**	**4.8800e-003**	**0.0000**	**125.9080**

3.7 Builidng Construction 2022 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.0400e-003	0.0685	0.1286	3.2000e-004	9.1300e-003	1.3300e-003	0.0105	2.6000e-003	1.2300e-003	3.8300e-003	0.0000	27.1464	27.1464	2.0000e-004	0.0000	27.1506
Worker	0.0248	0.0428	0.4451	1.5500e-003	0.1228	1.0300e-003	0.1238	0.0326	9.5000e-004	0.0336	0.0000	98.6590	98.6590	4.6800e-003	0.0000	98.7574
Total	**0.0338**	**0.1112**	**0.5736**	**1.8700e-003**	**0.1319**	**2.3600e-003**	**0.1343**	**0.0352**	**2.1800e-003**	**0.0374**	**0.0000**	**125.8054**	**125.8054**	**4.8800e-003**	**0.0000**	**125.9080**

3.8 Building Construction 2023 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.0100e-003	0.0324	0.0741	1.9000e-004	5.4800e-003	7.9000e-004	6.2700e-003	1.5600e-003	7.3000e-004	2.2900e-003	0.0000	16.2102	16.2102	1.1000e-004	0.0000	16.2125
Worker	0.0157	0.0270	0.2810	1.0400e-003	0.0825	6.9000e-004	0.0832	0.0219	6.4000e-004	0.0225	0.0000	65.2550	65.2550	3.0200e-003	0.0000	65.3185
Total	**0.0207**	**0.0594**	**0.3551**	**1.2300e-003**	**0.0880**	**1.4800e-003**	**0.0894**	**0.0235**	**1.3700e-003**	**0.0248**	**0.0000**	**81.4653**	**81.4653**	**3.1300e-003**	**0.0000**	**81.5310**

3.8 Building Construction 2023 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.0100e-003	0.0324	0.0741	1.9000e-004	5.4800e-003	7.9000e-004	6.2700e-003	1.5600e-003	7.3000e-004	2.2900e-003	0.0000	16.2102	16.2102	1.1000e-004	0.0000	16.2125
Worker	0.0157	0.0270	0.2810	1.0400e-003	0.0825	6.9000e-004	0.0832	0.0219	6.4000e-004	0.0225	0.0000	65.2550	65.2550	3.0200e-003	0.0000	65.3185
Total	**0.0207**	**0.0594**	**0.3551**	**1.2300e-003**	**0.0880**	**1.4800e-003**	**0.0894**	**0.0235**	**1.3700e-003**	**0.0248**	**0.0000**	**81.4653**	**81.4653**	**3.1300e-003**	**0.0000**	**81.5310**

3.9 Building Construction 2024 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.1100e-003	0.0595	0.1340	3.5000e-004	0.0101	1.4600e-003	0.0116	2.8900e-003	1.3500e-003	4.2300e-003	0.0000	30.0140	30.0140	2.0000e-004	0.0000	30.0182
Worker	0.0252	0.0430	0.4503	1.7700e-003	0.1392	1.1700e-003	0.1404	0.0370	1.0800e-003	0.0380	0.0000	109.2937	109.2937	4.9700e-003	0.0000	109.3980
Total	**0.0343**	**0.1025**	**0.5842**	**2.1200e-003**	**0.1493**	**2.6300e-003**	**0.1519**	**0.0399**	**2.4300e-003**	**0.0423**	**0.0000**	**139.3077**	**139.3077**	**5.1700e-003**	**0.0000**	**139.4162**

3.9 Building Construction 2024 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.1100e-003	0.0595	0.1340	3.5000e-004	0.0101	1.4600e-003	0.0116	2.8900e-003	1.3500e-003	4.2300e-003	0.0000	30.0140	30.0140	2.0000e-004	0.0000	30.0182
Worker	0.0252	0.0430	0.4503	1.7700e-003	0.1392	1.1700e-003	0.1404	0.0370	1.0800e-003	0.0380	0.0000	109.2937	109.2937	4.9700e-003	0.0000	109.3980
Total	**0.0343**	**0.1025**	**0.5842**	**2.1200e-003**	**0.1493**	**2.6300e-003**	**0.1519**	**0.0399**	**2.4300e-003**	**0.0423**	**0.0000**	**139.3077**	**139.3077**	**5.1700e-003**	**0.0000**	**139.4162**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Unmitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Unmitigated	385.8858	22.8052	0.0000	864.7950
Mitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

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Off-road Equipment - no offroad equipment in this run

Trips and VMT - From yearly analysis

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	152.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	260.00

tblConstructionPhase	NumDays	4,650.00	260.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	PhaseEndDate	12/29/2017	12/31/2017
tblConstructionPhase	PhaseStartDate	12/31/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	12/30/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	110.00
tblTripsAndVMT	VendorTripNumber	419.00	222.00
tblTripsAndVMT	VendorTripNumber	419.00	26.00
tblTripsAndVMT	VendorTripNumber	419.00	10.00
tblTripsAndVMT	VendorTripNumber	419.00	6.00
tblTripsAndVMT	VendorTripNumber	419.00	11.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	385.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	651.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	172.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	64.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	43.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	72.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.1533	4.3080	19.4129	0.0462	3.1629	0.0731	3.2360	0.8434	0.0673	0.9107	0.0000	3,910.6090	3,910.6090	0.1654	0.0000	3,914.0820
2018	1.0445	3.9429	17.7959	0.0462	3.1629	0.0695	3.2324	0.8434	0.0641	0.9075	0.0000	3,784.2601	3,784.2601	0.1541	0.0000	3,787.4957
2019	2.2227	10.3899	36.5806	0.1019	6.5807	0.1852	6.7659	1.7603	0.1707	1.9310	0.0000	8,251.9575	8,251.9575	0.2936	0.0000	8,258.1229
2020	3.7951	17.8966	61.4653	0.1811	11.3848	0.3333	11.7180	3.0497	0.3072	3.3569	0.0000	14,304.3143	14,304.3143	0.4776	0.0000	14,314.3447
2021	0.7361	2.2742	12.6315	0.0398	2.7747	0.0482	2.8229	0.7394	0.0445	0.7839	0.0000	2,985.8246	2,985.8246	0.1158	0.0000	2,988.2566
2022	0.2632	0.7931	4.4737	0.0149	1.0348	0.0181	1.0529	0.2758	0.0167	0.2925	0.0000	1,103.6043	1,103.6043	0.0414	0.0000	1,104.4739
2023	0.1616	0.4215	2.7800	9.8300e-003	0.6901	0.0113	0.7014	0.1838	0.0105	0.1943	0.0000	715.1406	715.1406	0.0265	0.0000	715.6977
2024	0.2650	0.7248	4.5238	0.0168	1.1623	0.0200	1.1824	0.3098	0.0185	0.3282	0.0000	1,212.9086	1,212.9086	0.0435	0.0000	1,213.8217
Total	**9.6415**	**40.7510**	**159.6637**	**0.4568**	**29.9532**	**0.7588**	**30.7120**	**8.0055**	**0.6995**	**8.7050**	**0.0000**	**36,268.6189**	**36,268.6189**	**1.3179**	**0.0000**	**36,296.2952**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.1533	4.3080	19.4129	0.0462	3.1629	0.0731	3.2360	0.8434	0.0673	0.9107	0.0000	3,910.6090	3,910.6090	0.1654	0.0000	3,914.0820
2018	1.0445	3.9429	17.7959	0.0462	3.1629	0.0695	3.2324	0.8434	0.0641	0.9075	0.0000	3,784.2601	3,784.2601	0.1541	0.0000	3,787.4957
2019	2.2227	10.3899	36.5806	0.1019	6.5807	0.1852	6.7659	1.7603	0.1707	1.9310	0.0000	8,251.9575	8,251.9575	0.2936	0.0000	8,258.1229
2020	3.7951	17.8966	61.4653	0.1811	11.3848	0.3333	11.7180	3.0497	0.3072	3.3569	0.0000	14,304.3143	14,304.3143	0.4776	0.0000	14,314.3447
2021	0.7361	2.2742	12.6315	0.0398	2.7747	0.0482	2.8229	0.7394	0.0445	0.7839	0.0000	2,985.8246	2,985.8246	0.1158	0.0000	2,988.2566
2022	0.2632	0.7931	4.4737	0.0149	1.0348	0.0181	1.0529	0.2758	0.0167	0.2925	0.0000	1,103.6043	1,103.6043	0.0414	0.0000	1,104.4739
2023	0.1616	0.4215	2.7800	9.8300e-003	0.6901	0.0113	0.7014	0.1838	0.0105	0.1943	0.0000	715.1406	715.1406	0.0265	0.0000	715.6977
2024	0.2650	0.7248	4.5238	0.0168	1.1623	0.0200	1.1824	0.3098	0.0185	0.3282	0.0000	1,212.9086	1,212.9086	0.0435	0.0000	1,213.8217
Total	**9.6415**	**40.7510**	**159.6637**	**0.4568**	**29.9532**	**0.7588**	**30.7120**	**8.0055**	**0.6995**	**8.7050**	**0.0000**	**36,268.6189**	**36,268.6189**	**1.3179**	**0.0000**	**36,296.2952**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Building Construction 2017	Building Construction	6/1/2017	12/31/2017	5	152	
2	Building Construction 2018	Building Construction	1/1/2018	12/31/2018	5	261	
3	Building Construction 2019	Building Construction	1/1/2019	12/31/2019	5	261	
4	Building Construction 2020	Building Construction	1/1/2020	12/31/2020	5	262	
5	Building Construction 2021	Building Construction	1/1/2021	12/31/2021	5	261	
6	Builidng Construction 2022	Building Construction	1/1/2022	12/30/2022	5	260	
7	Building Construction 2023	Building Construction	1/1/2023	12/29/2023	5	260	
8	Building Construction 2024	Building Construction	1/1/2024	12/31/2024	5	262	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Building Construction 2017	Cranes	0	7.00	226	0.29
Building Construction 2018	Cranes	0	7.00	226	0.29
Building Construction 2019	Cranes	0	7.00	226	0.29
Building Construction 2020	Cranes	0	7.00	226	0.29
Building Construction 2021	Cranes	0	7.00	226	0.29
Builidng Construction 2022	Cranes	0	7.00	226	0.29
Building Construction 2023	Cranes	0	7.00	226	0.29
Building Construction 2024	Cranes	0	7.00	226	0.29

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Building Construction 2017	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2018	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2019	0	385.00	110.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2020	0	651.00	222.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2021	0	172.00	26.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Builidng Construction 2022	0	64.00	10.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2023	0	43.00	6.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2024	0	72.00	11.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Building Construction 2017 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2768	3.0127	3.3564	8.4500e-003	0.2428	0.0472	0.2900	0.0691	0.0434	0.1125		834.9015	834.9015	5.9200e-003		835.0259
Worker	0.8765	1.2954	16.0565	0.0378	2.9201	0.0259	2.9460	0.7743	0.0239	0.7982		3,075.7074	3,075.7074	0.1595		3,079.0562
Total	**1.1533**	**4.3080**	**19.4129**	**0.0462**	**3.1629**	**0.0731**	**3.2360**	**0.8434**	**0.0673**	**0.9107**		**3,910.6090**	**3,910.6090**	**0.1654**		**3,914.0820**

3.2 Building Construction 2017 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2768	3.0127	3.3564	8.4500e-003	0.2428	0.0472	0.2900	0.0691	0.0434	0.1125		834.9015	834.9015	5.9200e-003		835.0259
Worker	0.8765	1.2954	16.0565	0.0378	2.9201	0.0259	2.9460	0.7743	0.0239	0.7982		3,075.7074	3,075.7074	0.1595		3,079.0562
Total	**1.1533**	**4.3080**	**19.4129**	**0.0462**	**3.1629**	**0.0731**	**3.2360**	**0.8434**	**0.0673**	**0.9107**		**3,910.6090**	**3,910.6090**	**0.1654**		**3,914.0820**

3.3 Building Construction 2018 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2612	2.7669	3.2053	8.4400e-003	0.2428	0.0445	0.2873	0.0691	0.0409	0.1100		821.1121	821.1121	5.8800e-003		821.2357
Worker	0.7834	1.1761	14.5906	0.0378	2.9201	0.0251	2.9452	0.7743	0.0232	0.7975		2,963.1480	2,963.1480	0.1482		2,966.2601
Total	**1.0445**	**3.9429**	**17.7959**	**0.0462**	**3.1629**	**0.0695**	**3.2324**	**0.8434**	**0.0641**	**0.9075**		**3,784.2601**	**3,784.2601**	**0.1541**		**3,787.4957**

3.3 Building Construction 2018 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2612	2.7669	3.2053	8.4400e-003	0.2428	0.0445	0.2873	0.0691	0.0409	0.1100		821.1121	821.1121	5.8800e-003		821.2357
Worker	0.7834	1.1761	14.5906	0.0378	2.9201	0.0251	2.9452	0.7743	0.0232	0.7975		2,963.1480	2,963.1480	0.1482		2,966.2601
Total	**1.0445**	**3.9429**	**17.7959**	**0.0462**	**3.1629**	**0.0695**	**3.2324**	**0.8434**	**0.0641**	**0.9075**		**3,784.2601**	**3,784.2601**	**0.1541**		**3,787.4957**

3.4 Building Construction 2019 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.8021	8.2492	9.9880	0.0272	0.7856	0.1368	0.9224	0.2235	0.1258	0.3494		2,601.9579	2,601.9579	0.0186		2,602.3483
Worker	1.4206	2.1407	26.5927	0.0747	5.7951	0.0485	5.8435	1.5367	0.0449	1.5816		5,649.9996	5,649.9996	0.2750		5,655.7746
Total	**2.2227**	**10.3899**	**36.5806**	**0.1019**	**6.5807**	**0.1852**	**6.7659**	**1.7603**	**0.1707**	**1.9310**		**8,251.9575**	**8,251.9575**	**0.2936**		**8,258.1229**

3.4 Building Construction 2019 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.8021	8.2492	9.9880	0.0272	0.7856	0.1368	0.9224	0.2235	0.1258	0.3494		2,601.9579	2,601.9579	0.0186		2,602.3483
Worker	1.4206	2.1407	26.5927	0.0747	5.7951	0.0485	5.8435	1.5367	0.0449	1.5816		5,649.9996	5,649.9996	0.2750		5,655.7746
Total	**2.2227**	**10.3899**	**36.5806**	**0.1019**	**6.5807**	**0.1852**	**6.7659**	**1.7603**	**0.1707**	**1.9310**		**8,251.9575**	**8,251.9575**	**0.2936**		**8,258.1229**

3.5 Building Construction 2020 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.5486	14.5392	19.5416	0.0548	1.5858	0.2523	1.8381	0.4513	0.2321	0.6833		5,134.2058	5,134.2058	0.0367		5,134.9764
Worker	2.2464	3.3574	41.9237	0.1263	9.7990	0.0810	9.8800	2.5984	0.0751	2.6735		9,170.1085	9,170.1085	0.4409		9,179.3683
Total	**3.7951**	**17.8966**	**61.4653**	**0.1811**	**11.3848**	**0.3333**	**11.7180**	**3.0497**	**0.3072**	**3.3569**		**14,304.3143**	**14,304.3143**	**0.4776**		**14,314.3447**

3.5 Building Construction 2020 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.5486	14.5392	19.5416	0.0548	1.5858	0.2523	1.8381	0.4513	0.2321	0.6833		5,134.2058	5,134.2058	0.0367		5,134.9764
Worker	2.2464	3.3574	41.9237	0.1263	9.7990	0.0810	9.8800	2.5984	0.0751	2.6735		9,170.1085	9,170.1085	0.4409		9,179.3683
Total	**3.7951**	**17.8966**	**61.4653**	**0.1811**	**11.3848**	**0.3333**	**11.7180**	**3.0497**	**0.3072**	**3.3569**		**14,304.3143**	**14,304.3143**	**0.4776**		**14,314.3447**

3.6 Building Construction 2021 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1755	1.4456	2.2225	6.4100e-003	0.1857	0.0269	0.2126	0.0529	0.0248	0.0776		600.8422	600.8422	4.3200e-003		600.9329
Worker	0.5606	0.8286	10.4090	0.0334	2.5890	0.0213	2.6103	0.6865	0.0198	0.7063		2,384.9824	2,384.9824	0.1115		2,387.3237
Total	**0.7361**	**2.2742**	**12.6315**	**0.0398**	**2.7747**	**0.0482**	**2.8229**	**0.7394**	**0.0445**	**0.7839**		**2,985.8246**	**2,985.8246**	**0.1158**		**2,988.2566**

3.6 Building Construction 2021 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1755	1.4456	2.2225	6.4100e-003	0.1857	0.0269	0.2126	0.0529	0.0248	0.0776		600.8422	600.8422	4.3200e-003		600.9329
Worker	0.5606	0.8286	10.4090	0.0334	2.5890	0.0213	2.6103	0.6865	0.0198	0.7063		2,384.9824	2,384.9824	0.1115		2,387.3237
Total	**0.7361**	**2.2742**	**12.6315**	**0.0398**	**2.7747**	**0.0482**	**2.8229**	**0.7394**	**0.0445**	**0.7839**		**2,985.8246**	**2,985.8246**	**0.1158**		**2,988.2566**

3.7 Builidng Construction 2022 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0662	0.5044	0.8338	2.4600e-003	0.0714	0.0102	0.0817	0.0203	9.4200e-003	0.0298		230.9027	230.9027	1.7000e-003		230.9383
Worker	0.1970	0.2888	3.6399	0.0124	0.9633	7.8900e-003	0.9712	0.2555	7.3100e-003	0.2628		872.7017	872.7017	0.0397		873.5356
Total	**0.2632**	**0.7931**	**4.4737**	**0.0149**	**1.0348**	**0.0181**	**1.0529**	**0.2758**	**0.0167**	**0.2925**		**1,103.6043**	**1,103.6043**	**0.0414**		**1,104.4739**

3.7 Builidng Construction 2022 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0662	0.5044	0.8338	2.4600e-003	0.0714	0.0102	0.0817	0.0203	9.4200e-003	0.0298		230.9027	230.9027	1.7000e-003		230.9383
Worker	0.1970	0.2888	3.6399	0.0124	0.9633	7.8900e-003	0.9712	0.2555	7.3100e-003	0.2628		872.7017	872.7017	0.0397		873.5356
Total	**0.2632**	**0.7931**	**4.4737**	**0.0149**	**1.0348**	**0.0181**	**1.0529**	**0.2758**	**0.0167**	**0.2925**		**1,103.6043**	**1,103.6043**	**0.0414**		**1,104.4739**

3.8 Building Construction 2023 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0367	0.2392	0.4792	1.4700e-003	0.0429	6.0600e-003	0.0489	0.0122	5.5800e-003	0.0178		137.8840	137.8840	9.1000e-004		137.9031
Worker	0.1249	0.1822	2.3009	8.3500e-003	0.6472	5.2700e-003	0.6525	0.1716	4.8900e-003	0.1765		577.2566	577.2566	0.0256		577.7946
Total	**0.1616**	**0.4215**	**2.7800**	**9.8200e-003**	**0.6901**	**0.0113**	**0.7014**	**0.1838**	**0.0105**	**0.1943**		**715.1406**	**715.1406**	**0.0265**		**715.6977**

3.8 Building Construction 2023 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0367	0.2392	0.4792	1.4700e-003	0.0429	6.0600e-003	0.0489	0.0122	5.5800e-003	0.0178		137.8840	137.8840	9.1000e-004		137.9031
Worker	0.1249	0.1822	2.3009	8.3500e-003	0.6472	5.2700e-003	0.6525	0.1716	4.8900e-003	0.1765		577.2566	577.2566	0.0256		577.7946
Total	**0.1616**	**0.4215**	**2.7800**	**9.8200e-003**	**0.6901**	**0.0113**	**0.7014**	**0.1838**	**0.0105**	**0.1943**		**715.1406**	**715.1406**	**0.0265**		**715.6977**

3.9 Building Construction 2024 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0662	0.4362	0.8602	2.7000e-003	0.0786	0.0111	0.0897	0.0224	0.0102	0.0326		253.3474	253.3474	1.6900e-003		253.3830
Worker	0.1988	0.2886	3.6636	0.0141	1.0838	8.9000e-003	1.0927	0.2874	8.2600e-003	0.2956		959.5611	959.5611	0.0418		960.4387
Total	**0.2650**	**0.7248**	**4.5238**	**0.0168**	**1.1623**	**0.0200**	**1.1824**	**0.3098**	**0.0185**	**0.3282**		**1,212.9086**	**1,212.9086**	**0.0435**		**1,213.8217**

3.9 Building Construction 2024 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0662	0.4362	0.8602	2.7000e-003	0.0786	0.0111	0.0897	0.0224	0.0102	0.0326		253.3474	253.3474	1.6900e-003		253.3830
Worker	0.1988	0.2886	3.6636	0.0141	1.0838	8.9000e-003	1.0927	0.2874	8.2600e-003	0.2956		959.5611	959.5611	0.0418		960.4387
Total	**0.2650**	**0.7248**	**4.5238**	**0.0168**	**1.1623**	**0.0200**	**1.1824**	**0.3098**	**0.0185**	**0.3282**		**1,212.9086**	**1,212.9086**	**0.0435**		**1,213.8217**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Unmitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Utility Installation & Building Construction

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Based on Client provided data

Off-road Equipment -

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Off-road Equipment - no offroad equipment in this run

Trips and VMT - From yearly analysis

On-road Fugitive Dust - Offroad equipment modeled as vendor trips is assumed to operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	4,650.00	152.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	NumDays	4,650.00	261.00
tblConstructionPhase	NumDays	4,650.00	260.00

tblConstructionPhase	NumDays	4,650.00	260.00
tblConstructionPhase	NumDays	4,650.00	262.00
tblConstructionPhase	PhaseEndDate	12/29/2017	12/31/2017
tblConstructionPhase	PhaseStartDate	12/31/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	12/30/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	34.00
tblTripsAndVMT	VendorTripNumber	419.00	110.00
tblTripsAndVMT	VendorTripNumber	419.00	222.00
tblTripsAndVMT	VendorTripNumber	419.00	26.00
tblTripsAndVMT	VendorTripNumber	419.00	10.00
tblTripsAndVMT	VendorTripNumber	419.00	6.00
tblTripsAndVMT	VendorTripNumber	419.00	11.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	194.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	385.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	651.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	172.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	64.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	43.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	72.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2036	4.5284	18.9866	0.0440	3.1629	0.0735	3.2364	0.8434	0.0677	0.9111	0.0000	3,731.0322	3,731.0322	0.1655	0.0000	3,734.5086
2018	1.0874	4.1425	17.4073	0.0440	3.1629	0.0699	3.2328	0.8434	0.0645	0.9079	0.0000	3,610.8983	3,610.8983	0.1542	0.0000	3,614.1374
2019	2.3265	10.8315	36.8111	0.0974	6.5807	0.1864	6.7671	1.7603	0.1718	1.9320	0.0000	7,913.3103	7,913.3103	0.2941	0.0000	7,919.4871
2020	3.9810	18.6197	62.7589	0.1735	11.3848	0.3352	11.7199	3.0497	0.3089	3.3586	0.0000	13,747.2145	13,747.2145	0.4788	0.0000	13,757.2685
2021	0.7639	2.3996	12.3157	0.0379	2.7747	0.0484	2.8231	0.7394	0.0447	0.7841	0.0000	2,846.1876	2,846.1876	0.1160	0.0000	2,848.6225
2022	0.2732	0.8367	4.3721	0.0142	1.0348	0.0182	1.0530	0.2758	0.0168	0.2926	0.0000	1,052.3632	1,052.3632	0.0415	0.0000	1,053.2339
2023	0.1677	0.4461	2.7034	9.3400e-003	0.6901	0.0114	0.7015	0.1838	0.0105	0.1943	0.0000	681.3066	681.3066	0.0266	0.0000	681.8644
2024	0.2752	0.7646	4.4199	0.0160	1.1623	0.0201	1.1824	0.3098	0.0186	0.3283	0.0000	1,156.3389	1,156.3389	0.0435	0.0000	1,157.2533
Total	**10.0784**	**42.5691**	**159.7748**	**0.4363**	**29.9532**	**0.7631**	**30.7162**	**8.0055**	**0.7034**	**8.7089**	**0.0000**	**34,738.6515**	**34,738.6515**	**1.3202**	**0.0000**	**34,766.3757**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	1.2036	4.5284	18.9866	0.0440	3.1629	0.0735	3.2364	0.8434	0.0677	0.9111	0.0000	3,731.0322	3,731.0322	0.1655	0.0000	3,734.5086
2018	1.0874	4.1425	17.4073	0.0440	3.1629	0.0699	3.2328	0.8434	0.0645	0.9079	0.0000	3,610.8983	3,610.8983	0.1542	0.0000	3,614.1374
2019	2.3265	10.8315	36.8111	0.0974	6.5807	0.1864	6.7671	1.7603	0.1718	1.9320	0.0000	7,913.3103	7,913.3103	0.2941	0.0000	7,919.4871
2020	3.9810	18.6197	62.7589	0.1735	11.3848	0.3352	11.7199	3.0497	0.3089	3.3586	0.0000	13,747.2145	13,747.2145	0.4788	0.0000	13,757.2685
2021	0.7639	2.3996	12.3157	0.0379	2.7747	0.0484	2.8231	0.7394	0.0447	0.7841	0.0000	2,846.1876	2,846.1876	0.1160	0.0000	2,848.6225
2022	0.2732	0.8367	4.3721	0.0142	1.0348	0.0182	1.0530	0.2758	0.0168	0.2926	0.0000	1,052.3632	1,052.3632	0.0415	0.0000	1,053.2339
2023	0.1677	0.4461	2.7034	9.3400e-003	0.6901	0.0114	0.7015	0.1838	0.0105	0.1943	0.0000	681.3066	681.3066	0.0266	0.0000	681.8644
2024	0.2752	0.7646	4.4199	0.0160	1.1623	0.0201	1.1824	0.3098	0.0186	0.3283	0.0000	1,156.3389	1,156.3389	0.0435	0.0000	1,157.2533
Total	**10.0784**	**42.5691**	**159.7748**	**0.4363**	**29.9532**	**0.7631**	**30.7162**	**8.0055**	**0.7034**	**8.7089**	**0.0000**	**34,738.6515**	**34,738.6515**	**1.3202**	**0.0000**	**34,766.3757**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Building Construction 2017	Building Construction	6/1/2017	12/31/2017	5	152	
2	Building Construction 2018	Building Construction	1/1/2018	12/31/2018	5	261	
3	Building Construction 2019	Building Construction	1/1/2019	12/31/2019	5	261	
4	Building Construction 2020	Building Construction	1/1/2020	12/31/2020	5	262	
5	Building Construction 2021	Building Construction	1/1/2021	12/31/2021	5	261	
6	Builidng Construction 2022	Building Construction	1/1/2022	12/30/2022	5	260	
7	Building Construction 2023	Building Construction	1/1/2023	12/29/2023	5	260	
8	Building Construction 2024	Building Construction	1/1/2024	12/31/2024	5	262	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Building Construction 2017	Cranes	0	7.00	226	0.29
Building Construction 2018	Cranes	0	7.00	226	0.29
Building Construction 2019	Cranes	0	7.00	226	0.29
Building Construction 2020	Cranes	0	7.00	226	0.29
Building Construction 2021	Cranes	0	7.00	226	0.29
Builidng Construction 2022	Cranes	0	7.00	226	0.29
Building Construction 2023	Cranes	0	7.00	226	0.29
Building Construction 2024	Cranes	0	7.00	226	0.29

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Building Construction 2017	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2018	0	194.00	34.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2019	0	385.00	110.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2020	0	651.00	222.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2021	0	172.00	26.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Builidng Construction 2022	0	64.00	10.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2023	0	43.00	6.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2024	0	72.00	11.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Building Construction 2017 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.3025	3.0916	4.1018	8.4000e-003	0.2428	0.0476	0.2904	0.0691	0.0438	0.1129		828.7704	828.7704	6.0800e-003		828.8981
Worker	0.9011	1.4368	14.8848	0.0356	2.9201	0.0259	2.9460	0.7743	0.0239	0.7982		2,902.2619	2,902.2619	0.1595		2,905.6106
Total	**1.2036**	**4.5284**	**18.9866**	**0.0440**	**3.1629**	**0.0735**	**3.2364**	**0.8434**	**0.0677**	**0.9111**		**3,731.0322**	**3,731.0322**	**0.1655**		**3,734.5086**

3.2 Building Construction 2017 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.3025	3.0916	4.1018	8.4000e-003	0.2428	0.0476	0.2904	0.0691	0.0438	0.1129		828.7704	828.7704	6.0800e-003		828.8981
Worker	0.9011	1.4368	14.8848	0.0356	2.9201	0.0259	2.9460	0.7743	0.0239	0.7982		2,902.2619	2,902.2619	0.1595		2,905.6106
Total	**1.2036**	**4.5284**	**18.9866**	**0.0440**	**3.1629**	**0.0735**	**3.2364**	**0.8434**	**0.0677**	**0.9111**		**3,731.0322**	**3,731.0322**	**0.1655**		**3,734.5086**

3.3 Building Construction 2018 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2843	2.8381	3.9427	8.3900e-003	0.2428	0.0449	0.2876	0.0691	0.0413	0.1103		815.0710	815.0710	6.0500e-003		815.1980
Worker	0.8031	1.3044	13.4645	0.0356	2.9201	0.0251	2.9452	0.7743	0.0232	0.7975		2,795.8273	2,795.8273	0.1482		2,798.9394
Total	**1.0874**	**4.1425**	**17.4073**	**0.0440**	**3.1629**	**0.0699**	**3.2328**	**0.8434**	**0.0645**	**0.9079**		**3,610.8983**	**3,610.8983**	**0.1542**		**3,614.1374**

3.3 Building Construction 2018 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2843	2.8381	3.9427	8.3900e-003	0.2428	0.0449	0.2876	0.0691	0.0413	0.1103		815.0710	815.0710	6.0500e-003		815.1980
Worker	0.8031	1.3044	13.4645	0.0356	2.9201	0.0251	2.9452	0.7743	0.0232	0.7975		2,795.8273	2,795.8273	0.1482		2,798.9394
Total	**1.0874**	**4.1425**	**17.4073**	**0.0440**	**3.1629**	**0.0699**	**3.2328**	**0.8434**	**0.0645**	**0.9079**		**3,610.8983**	**3,610.8983**	**0.1542**		**3,614.1374**

3.4 Building Construction 2019 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.8717	8.4573	12.3447	0.0270	0.7856	0.1379	0.9235	0.2235	0.1269	0.3504		2,582.7055	2,582.7055	0.0191		2,583.1073
Worker	1.4548	2.3742	24.4664	0.0704	5.7951	0.0485	5.8435	1.5367	0.0449	1.5816		5,330.6048	5,330.6048	0.2750		5,336.3798
Total	**2.3265**	**10.8315**	**36.8111**	**0.0974**	**6.5807**	**0.1864**	**6.7671**	**1.7603**	**0.1718**	**1.9320**		**7,913.3103**	**7,913.3103**	**0.2941**		**7,919.4871**

3.4 Building Construction 2019 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.8717	8.4573	12.3447	0.0270	0.7856	0.1379	0.9235	0.2235	0.1269	0.3504		2,582.7055	2,582.7055	0.0191		2,583.1073
Worker	1.4548	2.3742	24.4664	0.0704	5.7951	0.0485	5.8435	1.5367	0.0449	1.5816		5,330.6048	5,330.6048	0.2750		5,336.3798
Total	**2.3265**	**10.8315**	**36.8111**	**0.0974**	**6.5807**	**0.1864**	**6.7671**	**1.7603**	**0.1718**	**1.9320**		**7,913.3103**	**7,913.3103**	**0.2941**		**7,919.4871**

3.5 Building Construction 2020 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.6810	14.8975	24.2529	0.0545	1.5858	0.2542	1.8400	0.4513	0.2338	0.6851		5,096.1199	5,096.1199	0.0378		5,096.9141
Worker	2.3000	3.7222	38.5060	0.1190	9.7990	0.0810	9.8800	2.5984	0.0751	2.6735		8,651.0946	8,651.0946	0.4409		8,660.3544
Total	**3.9810**	**18.6197**	**62.7589**	**0.1735**	**11.3848**	**0.3352**	**11.7199**	**3.0497**	**0.3089**	**3.3586**		**13,747.2145**	**13,747.2145**	**0.4788**		**13,757.2685**

3.5 Building Construction 2020 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.6810	14.8975	24.2529	0.0545	1.5858	0.2542	1.8400	0.4513	0.2338	0.6851		5,096.1199	5,096.1199	0.0378		5,096.9141
Worker	2.3000	3.7222	38.5060	0.1190	9.7990	0.0810	9.8800	2.5984	0.0751	2.6735		8,651.0946	8,651.0946	0.4409		8,660.3544
Total	**3.9810**	**18.6197**	**62.7589**	**0.1735**	**11.3848**	**0.3352**	**11.7199**	**3.0497**	**0.3089**	**3.3586**		**13,747.2145**	**13,747.2145**	**0.4788**		**13,757.2685**

3.6 Building Construction 2021 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1901	1.4813	2.7697	6.3700e-003	0.1857	0.0271	0.2128	0.0529	0.0249	0.0778		596.3812	596.3812	4.4600e-003		596.4748
Worker	0.5738	0.9184	9.5459	0.0315	2.5890	0.0213	2.6103	0.6865	0.0198	0.7063		2,249.8064	2,249.8064	0.1115		2,252.1477
Total	**0.7639**	**2.3996**	**12.3157**	**0.0379**	**2.7747**	**0.0484**	**2.8231**	**0.7394**	**0.0447**	**0.7841**		**2,846.1876**	**2,846.1876**	**0.1160**		**2,848.6225**

3.6 Building Construction 2021 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1901	1.4813	2.7697	6.3700e-003	0.1857	0.0271	0.2128	0.0529	0.0249	0.0778		596.3812	596.3812	4.4600e-003		596.4748
Worker	0.5738	0.9184	9.5459	0.0315	2.5890	0.0213	2.6103	0.6865	0.0198	0.7063		2,249.8064	2,249.8064	0.1115		2,252.1477
Total	**0.7639**	**2.3996**	**12.3157**	**0.0379**	**2.7747**	**0.0484**	**2.8231**	**0.7394**	**0.0447**	**0.7841**		**2,846.1876**	**2,846.1876**	**0.1160**		**2,848.6225**

3.7 Builidng Construction 2022 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0715	0.5168	1.0390	2.4500e-003	0.0714	0.0103	0.0817	0.0203	9.4800e-003	0.0298		229.1880	229.1880	1.7500e-003		229.2248
Worker	0.2017	0.3199	3.3331	0.0117	0.9633	7.8900e-003	0.9712	0.2555	7.3100e-003	0.2628		823.1751	823.1751	0.0397		824.0091
Total	**0.2732**	**0.8367**	**4.3721**	**0.0142**	**1.0348**	**0.0182**	**1.0530**	**0.2758**	**0.0168**	**0.2926**		**1,052.3632**	**1,052.3632**	**0.0415**		**1,053.2339**

3.7 Builidng Construction 2022 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0715	0.5168	1.0390	2.4500e-003	0.0714	0.0103	0.0817	0.0203	9.4800e-003	0.0298		229.1880	229.1880	1.7500e-003		229.2248
Worker	0.2017	0.3199	3.3331	0.0117	0.9633	7.8900e-003	0.9712	0.2555	7.3100e-003	0.2628		823.1751	823.1751	0.0397		824.0091
Total	**0.2732**	**0.8367**	**4.3721**	**0.0142**	**1.0348**	**0.0182**	**1.0530**	**0.2758**	**0.0168**	**0.2926**		**1,052.3632**	**1,052.3632**	**0.0415**		**1,053.2339**

3.8 Building Construction 2023 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0398	0.2443	0.5998	1.4600e-003	0.0429	6.1100e-003	0.0490	0.0122	5.6200e-003	0.0178		136.8550	136.8550	9.4000e-004		136.8748
Worker	0.1279	0.2018	2.1035	7.8700e-003	0.6472	5.2700e-003	0.6525	0.1716	4.8900e-003	0.1765		544.4516	544.4516	0.0256		544.9896
Total	**0.1677**	**0.4461**	**2.7034**	**9.3300e-003**	**0.6901**	**0.0114**	**0.7015**	**0.1838**	**0.0105**	**0.1943**		**681.3066**	**681.3066**	**0.0266**		**681.8644**

3.8 Building Construction 2023 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0398	0.2443	0.5998	1.4600e-003	0.0429	6.1100e-003	0.0490	0.0122	5.6200e-003	0.0178		136.8550	136.8550	9.4000e-004		136.8748
Worker	0.1279	0.2018	2.1035	7.8700e-003	0.6472	5.2700e-003	0.6525	0.1716	4.8900e-003	0.1765		544.4516	544.4516	0.0256		544.9896
Total	**0.1677**	**0.4461**	**2.7034**	**9.3300e-003**	**0.6901**	**0.0114**	**0.7015**	**0.1838**	**0.0105**	**0.1943**		**681.3066**	**681.3066**	**0.0266**		**681.8644**

3.9 Building Construction 2024 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0716	0.4452	1.0761	2.6900e-003	0.0786	0.0112	0.0898	0.0224	0.0103	0.0327		251.4608	251.4608	1.7500e-003		251.4976
Worker	0.2035	0.3194	3.3438	0.0133	1.0838	8.9000e-003	1.0927	0.2874	8.2600e-003	0.2956		904.8781	904.8781	0.0418		905.7557
Total	**0.2752**	**0.7646**	**4.4199**	**0.0160**	**1.1623**	**0.0201**	**1.1825**	**0.3098**	**0.0186**	**0.3283**		**1,156.3389**	**1,156.3389**	**0.0435**		**1,157.2533**

3.9 Building Construction 2024 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0716	0.4452	1.0761	2.6900e-003	0.0786	0.0112	0.0898	0.0224	0.0103	0.0327		251.4608	251.4608	1.7500e-003		251.4976
Worker	0.2035	0.3194	3.3438	0.0133	1.0838	8.9000e-003	1.0927	0.2874	8.2600e-003	0.2956		904.8781	904.8781	0.0418		905.7557
Total	**0.2752**	**0.7646**	**4.4199**	**0.0160**	**1.1623**	**0.0201**	**1.1825**	**0.3098**	**0.0186**	**0.3283**		**1,156.3389**	**1,156.3389**	**0.0435**		**1,157.2533**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Unmitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Architectural Coating

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction run, no need to factor in RPS

Land Use - Based on Project Description provided by the Client

Construction Phase - Based on Client provided information.

Off-road Equipment -

Off-road Equipment -

Trips and VMT - From yearly analysis

On-road Fugitive Dust -

Architectural Coating - Updated to include Parking Lot SQFT for Architectural Coating

Vehicle Trips -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
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tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00

tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	330.00	23.00
tblConstructionPhase	NumDays	330.00	92.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	33.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	NumDays	330.00	8.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	PhaseEndDate	3/9/2018	5/8/2018
tblConstructionPhase	PhaseEndDate	10/30/2018	6/24/2019
tblConstructionPhase	PhaseEndDate	12/16/2019	6/23/2020
tblConstructionPhase	PhaseEndDate	8/7/2020	2/16/2021
tblConstructionPhase	PhaseEndDate	3/11/2021	1/25/2022
tblConstructionPhase	PhaseEndDate	2/4/2022	1/11/2023
tblConstructionPhase	PhaseEndDate	2/3/2023	1/23/2024
tblConstructionPhase	PhaseStartDate	11/2/2017	1/1/2018
tblConstructionPhase	PhaseStartDate	5/9/2018	1/1/2019
tblConstructionPhase	PhaseStartDate	6/25/2019	1/1/2020
tblConstructionPhase	PhaseStartDate	6/24/2020	1/1/2021
tblConstructionPhase	PhaseStartDate	2/17/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	1/26/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	1/12/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53

tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	77.00
tblTripsAndVMT	WorkerTripNumber	316.00	130.00
tblTripsAndVMT	WorkerTripNumber	316.00	34.00
tblTripsAndVMT	WorkerTripNumber	316.00	13.00
tblTripsAndVMT	WorkerTripNumber	316.00	9.00
tblTripsAndVMT	WorkerTripNumber	316.00	14.00
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40

tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
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tblVehicleTrips	CNW_TL	7.90	6.90
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tblVehicleTrips	CW_TL	18.50	16.60
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tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	25.1301	0.0285	0.0567	1.2000e-004	6.6200e-003	2.0500e-003	8.6700e-003	1.7600e-003	2.0500e-003	3.8100e-003	0.0000	9.1214	9.1214	6.4000e-004	0.0000	9.1350
2018	25.1451	0.1047	0.2130	4.7000e-004	0.0265	7.1600e-003	0.0336	7.0300e-003	7.1400e-003	0.0142	0.0000	35.5789	35.5789	2.3600e-003	0.0000	35.6285
2019	25.1581	0.1452	0.4289	1.0800e-003	0.0710	8.6500e-003	0.0797	0.0189	8.6100e-003	0.0275	0.0000	77.3848	77.3848	4.4700e-003	0.0000	77.4785
2020	25.1666	0.1530	0.6077	1.7000e-003	0.1199	7.9400e-003	0.1278	0.0318	7.8700e-003	0.0397	0.0000	115.4971	115.4971	6.2300e-003	0.0000	115.6279
2021	25.1297	0.0283	0.0620	1.5000e-004	8.2800e-003	1.6200e-003	9.9000e-003	2.2000e-003	1.6200e-003	3.8200e-003	0.0000	10.9779	10.9779	6.2000e-004	0.0000	10.9909
2022	25.1263	0.0125	0.0213	5.0000e-005	1.6300e-003	7.1000e-004	2.3400e-003	4.3000e-004	7.1000e-004	1.1400e-003	0.0000	3.4806	3.4806	2.0000e-004	0.0000	3.4849
2023	25.1251	5.3900e-003	9.0500e-003	2.0000e-005	5.3000e-004	2.9000e-004	8.2000e-004	1.4000e-004	2.9000e-004	4.3000e-004	0.0000	1.4416	1.4416	8.0000e-005	0.0000	1.4432
2024	25.1261	0.0109	0.0211	5.0000e-005	1.7600e-003	5.3000e-004	2.2900e-003	4.7000e-004	5.3000e-004	1.0000e-003	0.0000	3.5492	3.5492	1.8000e-004	0.0000	3.5531
Total	**201.1071**	**0.4885**	**1.4197**	**3.6400e-003**	**0.2362**	**0.0290**	**0.2652**	**0.0627**	**0.0288**	**0.0916**	**0.0000**	**257.0314**	**257.0314**	**0.0148**	**0.0000**	**257.3419**

2.1 Overall Construction

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	25.1301	0.0285	0.0567	1.2000e-004	6.6200e-003	2.0500e-003	8.6700e-003	1.7600e-003	2.0500e-003	3.8100e-003	0.0000	9.1214	9.1214	6.4000e-004	0.0000	9.1350
2018	25.1451	0.1047	0.2130	4.7000e-004	0.0265	7.1600e-003	0.0336	7.0300e-003	7.1400e-003	0.0142	0.0000	35.5789	35.5789	2.3600e-003	0.0000	35.6285
2019	25.1581	0.1452	0.4289	1.0800e-003	0.0710	8.6500e-003	0.0797	0.0189	8.6100e-003	0.0275	0.0000	77.3847	77.3847	4.4700e-003	0.0000	77.4785
2020	25.1666	0.1530	0.6077	1.7000e-003	0.1199	7.9400e-003	0.1278	0.0318	7.8700e-003	0.0397	0.0000	115.4971	115.4971	6.2300e-003	0.0000	115.6279
2021	25.1297	0.0283	0.0620	1.5000e-004	8.2800e-003	1.6200e-003	9.9000e-003	2.2000e-003	1.6200e-003	3.8200e-003	0.0000	10.9779	10.9779	6.2000e-004	0.0000	10.9909
2022	25.1263	0.0125	0.0213	5.0000e-005	1.6300e-003	7.1000e-004	2.3400e-003	4.3000e-004	7.1000e-004	1.1400e-003	0.0000	3.4806	3.4806	2.0000e-004	0.0000	3.4849
2023	25.1251	5.3900e-003	9.0500e-003	2.0000e-005	5.3000e-004	2.9000e-004	8.2000e-004	1.4000e-004	2.9000e-004	4.3000e-004	0.0000	1.4416	1.4416	8.0000e-005	0.0000	1.4432
2024	25.1261	0.0109	0.0211	5.0000e-005	1.7600e-003	5.3000e-004	2.2900e-003	4.7000e-004	5.3000e-004	1.0000e-003	0.0000	3.5492	3.5492	1.8000e-004	0.0000	3.5531
Total	**201.1071**	**0.4885**	**1.4197**	**3.6400e-003**	**0.2362**	**0.0290**	**0.2652**	**0.0627**	**0.0288**	**0.0916**	**0.0000**	**257.0314**	**257.0314**	**0.0148**	**0.0000**	**257.3419**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	12.1737	29.2302	131.7574	0.4624	30.1194	0.6366	30.7560	8.0701	0.5874	8.6576	0.0000	31,271.2749	31,271.2749	1.0330	0.0000	31,292.9676
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**32.9184**	**31.1271**	**158.7081**	**0.4890**	**30.1194**	**2.3559**	**32.4752**	**8.0701**	**2.3064**	**10.3766**	**617.6942**	**40,694.0455**	**41,311.7397**	**31.3682**	**0.2703**	**42,054.2704**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	12.1737	29.2302	131.7574	0.4624	30.1194	0.6366	30.7560	8.0701	0.5874	8.6576	0.0000	31,271.2749	31,271.2749	1.0330	0.0000	31,292.9676
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**32.9184**	**31.1271**	**158.7081**	**0.4890**	**30.1194**	**2.3559**	**32.4752**	**8.0701**	**2.3064**	**10.3766**	**617.6942**	**40,694.0455**	**41,311.7397**	**31.3670**	**0.2701**	**42,054.1673**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Architectural Coating 1	Architectural Coating	10/1/2017	11/1/2017	5	23	
2	Architectural Coating 2	Architectural Coating	1/1/2018	5/8/2018	5	92	
3	Architectural Coating 3	Architectural Coating	1/1/2019	6/24/2019	5	125	
4	Architectural Coating 4	Architectural Coating	1/1/2020	6/23/2020	5	125	
5	Architectural Coating 5	Architectural Coating	1/1/2021	2/16/2021	5	33	
6	Architectural Coating 6	Architectural Coating	1/1/2022	1/25/2022	5	17	
7	Architectural Coating 7	Architectural Coating	1/1/2023	1/11/2023	5	8	
8	Architectural Coating 8	Architectural Coating	1/1/2024	1/23/2024	5	17	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 3,736,530; Residential Outdoor: 1,245,510; Non-Residential Indoor: 2,318,201; Non-Residential Outdoor: 772,733 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating 1	Air Compressors	1	6.00	78	0.48
Architectural Coating 2	Air Compressors	1	6.00	78	0.48
Architectural Coating 3	Air Compressors	1	6.00	78	0.48
Architectural Coating 4	Air Compressors	1	6.00	78	0.48
Architectural Coating 5	Air Compressors	1	6.00	78	0.48
Architectural Coating 6	Air Compressors	1	6.00	78	0.48
Architectural Coating 7	Air Compressors	1	6.00	78	0.48
Architectural Coating 8	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating 1	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 2	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 3	1	77.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 4	1	130.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 5	1	34.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 6	1	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 7	1	9.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 8	1	14.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Architectural Coating 1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.8200e-003	0.0251	0.0215	3.0000e-005		1.9900e-003	1.9900e-003		1.9900e-003	1.9900e-003	0.0000	2.9362	2.9362	3.1000e-004	0.0000	2.9428
Total	**25.1281**	**0.0251**	**0.0215**	**3.0000e-005**		**1.9900e-003**	**1.9900e-003**		**1.9900e-003**	**1.9900e-003**	**0.0000**	**2.9362**	**2.9362**	**3.1000e-004**	**0.0000**	**2.9428**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9800e-003	3.4100e-003	0.0352	8.0000e-005	6.6200e-003	6.0000e-005	6.6800e-003	1.7600e-003	6.0000e-005	1.8100e-003	0.0000	6.1852	6.1852	3.3000e-004	0.0000	6.1922
Total	**1.9800e-003**	**3.4100e-003**	**0.0352**	**8.0000e-005**	**6.6200e-003**	**6.0000e-005**	**6.6800e-003**	**1.7600e-003**	**6.0000e-005**	**1.8100e-003**	**0.0000**	**6.1852**	**6.1852**	**3.3000e-004**	**0.0000**	**6.1922**

3.2 Architectural Coating 1 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.8200e-003	0.0251	0.0215	3.0000e-005		1.9900e-003	1.9900e-003		1.9900e-003	1.9900e-003	0.0000	2.9362	2.9362	3.1000e-004	0.0000	2.9428
Total	**25.1281**	**0.0251**	**0.0215**	**3.0000e-005**		**1.9900e-003**	**1.9900e-003**		**1.9900e-003**	**1.9900e-003**	**0.0000**	**2.9362**	**2.9362**	**3.1000e-004**	**0.0000**	**2.9428**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9800e-003	3.4100e-003	0.0352	8.0000e-005	6.6200e-003	6.0000e-005	6.6800e-003	1.7600e-003	6.0000e-005	1.8100e-003	0.0000	6.1852	6.1852	3.3000e-004	0.0000	6.1922
Total	**1.9800e-003**	**3.4100e-003**	**0.0352**	**8.0000e-005**	**6.6200e-003**	**6.0000e-005**	**6.6800e-003**	**1.7600e-003**	**6.0000e-005**	**1.8100e-003**	**0.0000**	**6.1852**	**6.1852**	**3.3000e-004**	**0.0000**	**6.1922**

3.3 Architectural Coating 2 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0137	0.0923	0.0853	1.4000e-004		6.9300e-003	6.9300e-003		6.9300e-003	6.9300e-003	0.0000	11.7450	11.7450	1.1200e-003	0.0000	11.7684
Total	**25.1380**	**0.0923**	**0.0853**	**1.4000e-004**		**6.9300e-003**	**6.9300e-003**		**6.9300e-003**	**6.9300e-003**	**0.0000**	**11.7450**	**11.7450**	**1.1200e-003**	**0.0000**	**11.7684**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.0400e-003	0.0124	0.1277	3.3000e-004	0.0265	2.3000e-004	0.0267	7.0300e-003	2.1000e-004	7.2400e-003	0.0000	23.8339	23.8339	1.2400e-003	0.0000	23.8600
Total	**7.0400e-003**	**0.0124**	**0.1277**	**3.3000e-004**	**0.0265**	**2.3000e-004**	**0.0267**	**7.0300e-003**	**2.1000e-004**	**7.2400e-003**	**0.0000**	**23.8339**	**23.8339**	**1.2400e-003**	**0.0000**	**23.8600**

3.3 Architectural Coating 2 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0137	0.0923	0.0853	1.4000e-004		6.9300e-003	6.9300e-003		6.9300e-003	6.9300e-003	0.0000	11.7450	11.7450	1.1200e-003	0.0000	11.7684
Total	**25.1380**	**0.0923**	**0.0853**	**1.4000e-004**		**6.9300e-003**	**6.9300e-003**		**6.9300e-003**	**6.9300e-003**	**0.0000**	**11.7450**	**11.7450**	**1.1200e-003**	**0.0000**	**11.7684**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.0400e-003	0.0124	0.1277	3.3000e-004	0.0265	2.3000e-004	0.0267	7.0300e-003	2.1000e-004	7.2400e-003	0.0000	23.8339	23.8339	1.2400e-003	0.0000	23.8600
Total	**7.0400e-003**	**0.0124**	**0.1277**	**3.3000e-004**	**0.0265**	**2.3000e-004**	**0.0267**	**7.0300e-003**	**2.1000e-004**	**7.2400e-003**	**0.0000**	**23.8339**	**23.8339**	**1.2400e-003**	**0.0000**	**23.8600**

3.4 Architectural Coating 3 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0167	0.1147	0.1151	1.9000e-004		8.0500e-003	8.0500e-003		8.0500e-003	8.0500e-003	0.0000	15.9578	15.9578	1.3500e-003	0.0000	15.9861
Total	**25.1409**	**0.1147**	**0.1151**	**1.9000e-004**		**8.0500e-003**	**8.0500e-003**		**8.0500e-003**	**8.0500e-003**	**0.0000**	**15.9578**	**15.9578**	**1.3500e-003**	**0.0000**	**15.9861**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0172	0.0305	0.3138	8.9000e-004	0.0710	6.1000e-004	0.0716	0.0189	5.6000e-004	0.0194	0.0000	61.4269	61.4269	3.1200e-003	0.0000	61.4924
Total	**0.0172**	**0.0305**	**0.3138**	**8.9000e-004**	**0.0710**	**6.1000e-004**	**0.0716**	**0.0189**	**5.6000e-004**	**0.0194**	**0.0000**	**61.4269**	**61.4269**	**3.1200e-003**	**0.0000**	**61.4924**

3.4 Architectural Coating 3 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0167	0.1147	0.1151	1.9000e-004		8.0500e-003	8.0500e-003		8.0500e-003	8.0500e-003	0.0000	15.9578	15.9578	1.3500e-003	0.0000	15.9861
Total	**25.1409**	**0.1147**	**0.1151**	**1.9000e-004**		**8.0500e-003**	**8.0500e-003**		**8.0500e-003**	**8.0500e-003**	**0.0000**	**15.9578**	**15.9578**	**1.3500e-003**	**0.0000**	**15.9861**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0172	0.0305	0.3138	8.9000e-004	0.0710	6.1000e-004	0.0716	0.0189	5.6000e-004	0.0194	0.0000	61.4269	61.4269	3.1200e-003	0.0000	61.4924
Total	**0.0172**	**0.0305**	**0.3138**	**8.9000e-004**	**0.0710**	**6.1000e-004**	**0.0716**	**0.0189**	**5.6000e-004**	**0.0194**	**0.0000**	**61.4269**	**61.4269**	**3.1200e-003**	**0.0000**	**61.4924**

3.5 Architectural Coating 4 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1052	0.1145	1.9000e-004		6.9300e-003	6.9300e-003		6.9300e-003	6.9300e-003	0.0000	15.9578	15.9578	1.2400e-003	0.0000	15.9838
Total	**25.1394**	**0.1052**	**0.1145**	**1.9000e-004**		**6.9300e-003**	**6.9300e-003**		**6.9300e-003**	**6.9300e-003**	**0.0000**	**15.9578**	**15.9578**	**1.2400e-003**	**0.0000**	**15.9838**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0272	0.0478	0.4933	1.5100e-003	0.1199	1.0100e-003	0.1209	0.0318	9.4000e-004	0.0328	0.0000	99.5393	99.5393	4.9900e-003	0.0000	99.6441
Total	**0.0272**	**0.0478**	**0.4933**	**1.5100e-003**	**0.1199**	**1.0100e-003**	**0.1209**	**0.0318**	**9.4000e-004**	**0.0328**	**0.0000**	**99.5393**	**99.5393**	**4.9900e-003**	**0.0000**	**99.6441**

3.5 Architectural Coating 4 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1052	0.1145	1.9000e-004		6.9300e-003	6.9300e-003		6.9300e-003	6.9300e-003	0.0000	15.9578	15.9578	1.2400e-003	0.0000	15.9838
Total	**25.1394**	**0.1052**	**0.1145**	**1.9000e-004**		**6.9300e-003**	**6.9300e-003**		**6.9300e-003**	**6.9300e-003**	**0.0000**	**15.9578**	**15.9578**	**1.2400e-003**	**0.0000**	**15.9838**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0272	0.0478	0.4933	1.5100e-003	0.1199	1.0100e-003	0.1209	0.0318	9.4000e-004	0.0328	0.0000	99.5393	99.5393	4.9900e-003	0.0000	99.6441
Total	**0.0272**	**0.0478**	**0.4933**	**1.5100e-003**	**0.1199**	**1.0100e-003**	**0.1209**	**0.0318**	**9.4000e-004**	**0.0328**	**0.0000**	**99.5393**	**99.5393**	**4.9900e-003**	**0.0000**	**99.6441**

3.6 Architectural Coating 5 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6100e-003	0.0252	0.0300	5.0000e-005		1.5500e-003	1.5500e-003		1.5500e-003	1.5500e-003	0.0000	4.2129	4.2129	2.9000e-004	0.0000	4.2189
Total	**25.1279**	**0.0252**	**0.0300**	**5.0000e-005**		**1.5500e-003**	**1.5500e-003**		**1.5500e-003**	**1.5500e-003**	**0.0000**	**4.2129**	**4.2129**	**2.9000e-004**	**0.0000**	**4.2189**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7700e-003	3.0800e-003	0.0320	1.0000e-004	8.2800e-003	7.0000e-005	8.3500e-003	2.2000e-003	6.0000e-005	2.2600e-003	0.0000	6.7651	6.7651	3.3000e-004	0.0000	6.7720
Total	**1.7700e-003**	**3.0800e-003**	**0.0320**	**1.0000e-004**	**8.2800e-003**	**7.0000e-005**	**8.3500e-003**	**2.2000e-003**	**6.0000e-005**	**2.2600e-003**	**0.0000**	**6.7651**	**6.7651**	**3.3000e-004**	**0.0000**	**6.7720**

3.6 Architectural Coating 5 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6100e-003	0.0252	0.0300	5.0000e-005		1.5500e-003	1.5500e-003		1.5500e-003	1.5500e-003	0.0000	4.2129	4.2129	2.9000e-004	0.0000	4.2189
Total	**25.1279**	**0.0252**	**0.0300**	**5.0000e-005**		**1.5500e-003**	**1.5500e-003**		**1.5500e-003**	**1.5500e-003**	**0.0000**	**4.2129**	**4.2129**	**2.9000e-004**	**0.0000**	**4.2189**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7700e-003	3.0800e-003	0.0320	1.0000e-004	8.2800e-003	7.0000e-005	8.3500e-003	2.2000e-003	6.0000e-005	2.2600e-003	0.0000	6.7651	6.7651	3.3000e-004	0.0000	6.7720
Total	**1.7700e-003**	**3.0800e-003**	**0.0320**	**1.0000e-004**	**8.2800e-003**	**7.0000e-005**	**8.3500e-003**	**2.2000e-003**	**6.0000e-005**	**2.2600e-003**	**0.0000**	**6.7651**	**6.7651**	**3.3000e-004**	**0.0000**	**6.7720**

3.7 Architectural Coating 6 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.7400e-003	0.0120	0.0154	3.0000e-005		6.9000e-004	6.9000e-004		6.9000e-004	6.9000e-004	0.0000	2.1703	2.1703	1.4000e-004	0.0000	2.1732
Total	**25.1260**	**0.0120**	**0.0154**	**3.0000e-005**		**6.9000e-004**	**6.9000e-004**		**6.9000e-004**	**6.9000e-004**	**0.0000**	**2.1703**	**2.1703**	**1.4000e-004**	**0.0000**	**2.1732**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.9100e-003	2.0000e-005	1.6300e-003	1.0000e-005	1.6400e-003	4.3000e-004	1.0000e-005	4.5000e-004	0.0000	1.3103	1.3103	6.0000e-005	0.0000	1.3116
Total	**3.3000e-004**	**5.7000e-004**	**5.9100e-003**	**2.0000e-005**	**1.6300e-003**	**1.0000e-005**	**1.6400e-003**	**4.3000e-004**	**1.0000e-005**	**4.5000e-004**	**0.0000**	**1.3103**	**1.3103**	**6.0000e-005**	**0.0000**	**1.3116**

3.7 Architectural Coating 6 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.7400e-003	0.0120	0.0154	3.0000e-005		6.9000e-004	6.9000e-004		6.9000e-004	6.9000e-004	0.0000	2.1703	2.1703	1.4000e-004	0.0000	2.1732
Total	**25.1260**	**0.0120**	**0.0154**	**3.0000e-005**		**6.9000e-004**	**6.9000e-004**		**6.9000e-004**	**6.9000e-004**	**0.0000**	**2.1703**	**2.1703**	**1.4000e-004**	**0.0000**	**2.1732**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	5.7000e-004	5.9100e-003	2.0000e-005	1.6300e-003	1.0000e-005	1.6400e-003	4.3000e-004	1.0000e-005	4.5000e-004	0.0000	1.3103	1.3103	6.0000e-005	0.0000	1.3116
Total	**3.3000e-004**	**5.7000e-004**	**5.9100e-003**	**2.0000e-005**	**1.6300e-003**	**1.0000e-005**	**1.6400e-003**	**4.3000e-004**	**1.0000e-005**	**4.5000e-004**	**0.0000**	**1.3103**	**1.3103**	**6.0000e-005**	**0.0000**	**1.3116**

3.8 Architectural Coating 7 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.7000e-004	5.2100e-003	7.2400e-003	1.0000e-005		2.8000e-004	2.8000e-004		2.8000e-004	2.8000e-004	0.0000	1.0213	1.0213	6.0000e-005	0.0000	1.0226
Total	**25.1250**	**5.2100e-003**	**7.2400e-003**	**1.0000e-005**		**2.8000e-004**	**2.8000e-004**		**2.8000e-004**	**2.8000e-004**	**0.0000**	**1.0213**	**1.0213**	**6.0000e-005**	**0.0000**	**1.0226**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	1.7000e-004	1.8100e-003	1.0000e-005	5.3000e-004	0.0000	5.4000e-004	1.4000e-004	0.0000	1.5000e-004	0.0000	0.4203	0.4203	2.0000e-005	0.0000	0.4207
Total	**1.0000e-004**	**1.7000e-004**	**1.8100e-003**	**1.0000e-005**	**5.3000e-004**	**0.0000**	**5.4000e-004**	**1.4000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**0.4203**	**0.4203**	**2.0000e-005**	**0.0000**	**0.4207**

3.8 Architectural Coating 7 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.7000e-004	5.2100e-003	7.2400e-003	1.0000e-005		2.8000e-004	2.8000e-004		2.8000e-004	2.8000e-004	0.0000	1.0213	1.0213	6.0000e-005	0.0000	1.0226
Total	**25.1250**	**5.2100e-003**	**7.2400e-003**	**1.0000e-005**		**2.8000e-004**	**2.8000e-004**		**2.8000e-004**	**2.8000e-004**	**0.0000**	**1.0213**	**1.0213**	**6.0000e-005**	**0.0000**	**1.0226**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	1.7000e-004	1.8100e-003	1.0000e-005	5.3000e-004	0.0000	5.4000e-004	1.4000e-004	0.0000	1.5000e-004	0.0000	0.4203	0.4203	2.0000e-005	0.0000	0.4207
Total	**1.0000e-004**	**1.7000e-004**	**1.8100e-003**	**1.0000e-005**	**5.3000e-004**	**0.0000**	**5.4000e-004**	**1.4000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**0.4203**	**0.4203**	**2.0000e-005**	**0.0000**	**0.4207**

3.9 Architectural Coating 8 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5400e-003	0.0104	0.0154	3.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004	0.0000	2.1703	2.1703	1.2000e-004	0.0000	2.1728
Total	**25.1258**	**0.0104**	**0.0154**	**3.0000e-005**		**5.2000e-004**	**5.2000e-004**		**5.2000e-004**	**5.2000e-004**	**0.0000**	**2.1703**	**2.1703**	**1.2000e-004**	**0.0000**	**2.1728**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2000e-004	5.4000e-004	5.6800e-003	2.0000e-005	1.7600e-003	1.0000e-005	1.7700e-003	4.7000e-004	1.0000e-005	4.8000e-004	0.0000	1.3789	1.3789	6.0000e-005	0.0000	1.3802
Total	**3.2000e-004**	**5.4000e-004**	**5.6800e-003**	**2.0000e-005**	**1.7600e-003**	**1.0000e-005**	**1.7700e-003**	**4.7000e-004**	**1.0000e-005**	**4.8000e-004**	**0.0000**	**1.3789**	**1.3789**	**6.0000e-005**	**0.0000**	**1.3802**

3.9 Architectural Coating 8 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	25.1243					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5400e-003	0.0104	0.0154	3.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004	0.0000	2.1703	2.1703	1.2000e-004	0.0000	2.1728
Total	**25.1258**	**0.0104**	**0.0154**	**3.0000e-005**		**5.2000e-004**	**5.2000e-004**		**5.2000e-004**	**5.2000e-004**	**0.0000**	**2.1703**	**2.1703**	**1.2000e-004**	**0.0000**	**2.1728**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.2000e-004	5.4000e-004	5.6800e-003	2.0000e-005	1.7600e-003	1.0000e-005	1.7700e-003	4.7000e-004	1.0000e-005	4.8000e-004	0.0000	1.3789	1.3789	6.0000e-005	0.0000	1.3802
Total	**3.2000e-004**	**5.4000e-004**	**5.6800e-003**	**2.0000e-005**	**1.7600e-003**	**1.0000e-005**	**1.7700e-003**	**4.7000e-004**	**1.0000e-005**	**4.8000e-004**	**0.0000**	**1.3789**	**1.3789**	**6.0000e-005**	**0.0000**	**1.3802**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	12.1737	29.2302	131.7574	0.4624	30.1194	0.6366	30.7560	8.0701	0.5874	8.6576	0.0000	31,271.2749	31,271.2749	1.0330	0.0000	31,292.9676
Unmitigated	12.1737	29.2302	131.7574	0.4624	30.1194	0.6366	30.7560	8.0701	0.5874	8.6576	0.0000	31,271.2749	31,271.2749	1.0330	0.0000	31,292.9676

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	25,622	25,622
Condo/Townhouse	4,613.00	5,012.00	4249.00	15,780,408	15,780,408
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	12,060,740	12,060,740
Elementary School	967.50	0.00	0.00	2,381,697	2,381,697
General Office Building	4,789.35	1,030.95	426.30	11,691,142	11,691,142
Health Club	82.33	52.18	66.83	162,126	162,126
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	25,081,204	25,081,204
Single Family Housing	3,244.23	3,417.12	2973.03	11,038,035	11,038,035
Strip Mall	664.80	630.60	306.45	1,158,150	1,158,150
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	79,379,125	79,379,125

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	16.60	8.40	6.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Elementary School	16.60	8.40	6.90	65.00	30.00	5.00	63	25	12
General Office Building	16.60	8.40	6.90	33.00	48.00	19.00	77	19	4
Health Club	16.60	8.40	6.90	16.90	64.10	19.00	52	39	9
Parking Lot	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	16.60	8.40	6.90	16.30	64.70	19.00	54	35	11
Single Family Housing	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Strip Mall	16.60	8.40	6.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Unmitigated	385.8858	22.8052	0.0000	864.7950
Mitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Architectural Coating

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction run, no need to factor in RPS

Land Use - Based on Project Description provided by the Client

Construction Phase - Based on Client provided information.

Off-road Equipment -

Off-road Equipment -

Trips and VMT - From yearly analysis

On-road Fugitive Dust -

Architectural Coating - Updated to include Parking Lot SQFT for Architectural Coating

Vehicle Trips -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00

tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	330.00	23.00
tblConstructionPhase	NumDays	330.00	92.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	33.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	NumDays	330.00	8.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	PhaseEndDate	3/9/2018	5/8/2018
tblConstructionPhase	PhaseEndDate	10/30/2018	6/24/2019
tblConstructionPhase	PhaseEndDate	12/16/2019	6/23/2020
tblConstructionPhase	PhaseEndDate	8/7/2020	2/16/2021
tblConstructionPhase	PhaseEndDate	3/11/2021	1/25/2022
tblConstructionPhase	PhaseEndDate	2/4/2022	1/11/2023
tblConstructionPhase	PhaseEndDate	2/3/2023	1/23/2024
tblConstructionPhase	PhaseStartDate	11/2/2017	1/1/2018
tblConstructionPhase	PhaseStartDate	5/9/2018	1/1/2019
tblConstructionPhase	PhaseStartDate	6/25/2019	1/1/2020
tblConstructionPhase	PhaseStartDate	6/24/2020	1/1/2021
tblConstructionPhase	PhaseStartDate	2/17/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	1/26/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	1/12/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53

tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	77.00
tblTripsAndVMT	WorkerTripNumber	316.00	130.00
tblTripsAndVMT	WorkerTripNumber	316.00	34.00
tblTripsAndVMT	WorkerTripNumber	316.00	13.00
tblTripsAndVMT	WorkerTripNumber	316.00	9.00
tblTripsAndVMT	WorkerTripNumber	316.00	14.00
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40

tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	2,185.2279	2.4454	5.0959	0.0106	0.5870	0.1785	0.7656	0.1557	0.1781	0.3338	0.0000	899.7604	899.7604	0.0618	0.0000	901.0576
2018	546.6360	2.2422	4.7874	0.0106	0.5870	0.1556	0.7426	0.1557	0.1552	0.3109	0.0000	877.1329	877.1329	0.0565	0.0000	878.3202
2019	402.5389	2.2635	7.1599	0.0179	1.1590	0.1385	1.2975	0.3073	0.1378	0.4451	0.0000	1,411.4480	1,411.4480	0.0788	0.0000	1,413.1022
2020	402.6791	2.3543	10.2033	0.0282	1.9568	0.1271	2.0839	0.5189	0.1259	0.6448	0.0000	2,112.6525	2,112.6525	0.1098	0.0000	2,114.9592
2021	1,523.0129	1.6907	3.8752	9.5800e-003	0.5118	0.0983	0.6101	0.1357	0.0980	0.2337	0.0000	752.8981	752.8981	0.0414	0.0000	753.7665
2022	2,956.0413	1.4671	2.5529	5.5000e-003	0.1957	0.0833	0.2790	0.0519	0.0832	0.1351	0.0000	458.7156	458.7156	0.0264	0.0000	459.2698
2023	6,281.2859	1.3411	2.2927	4.7200e-003	0.1355	0.0719	0.2074	0.0359	0.0718	0.1078	0.0000	402.2692	402.2692	0.0222	0.0000	402.7354
2024	2,956.0162	1.2749	2.5225	5.7100e-003	0.2107	0.0627	0.2734	0.0559	0.0625	0.1184	0.0000	468.0294	468.0294	0.0240	0.0000	468.5328
Total	**17,253.4381**	**15.0793**	**38.4897**	**0.0928**	**5.3435**	**0.9159**	**6.2594**	**1.4170**	**0.9126**	**2.3296**	**0.0000**	**7,382.9060**	**7,382.9060**	**0.4208**	**0.0000**	**7,391.7436**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	2,185.2279	2.4454	5.0959	0.0106	0.5870	0.1785	0.7656	0.1557	0.1781	0.3338	0.0000	899.7604	899.7604	0.0618	0.0000	901.0576
2018	546.6360	2.2422	4.7874	0.0106	0.5870	0.1556	0.7426	0.1557	0.1552	0.3109	0.0000	877.1329	877.1329	0.0565	0.0000	878.3202
2019	402.5389	2.2635	7.1599	0.0179	1.1590	0.1385	1.2975	0.3073	0.1378	0.4451	0.0000	1,411.4480	1,411.4480	0.0788	0.0000	1,413.1022
2020	402.6791	2.3543	10.2033	0.0282	1.9568	0.1271	2.0839	0.5189	0.1259	0.6448	0.0000	2,112.6525	2,112.6525	0.1098	0.0000	2,114.9592
2021	1,523.0129	1.6907	3.8752	9.5800e-003	0.5118	0.0983	0.6101	0.1357	0.0980	0.2337	0.0000	752.8981	752.8981	0.0414	0.0000	753.7665
2022	2,956.0413	1.4671	2.5529	5.5000e-003	0.1957	0.0833	0.2790	0.0519	0.0832	0.1351	0.0000	458.7156	458.7156	0.0264	0.0000	459.2698
2023	6,281.2859	1.3411	2.2927	4.7200e-003	0.1355	0.0719	0.2074	0.0359	0.0718	0.1078	0.0000	402.2692	402.2692	0.0222	0.0000	402.7354
2024	2,956.0162	1.2749	2.5225	5.7100e-003	0.2107	0.0627	0.2734	0.0559	0.0625	0.1184	0.0000	468.0294	468.0294	0.0240	0.0000	468.5328
Total	**17,253.4381**	**15.0793**	**38.4897**	**0.0928**	**5.3435**	**0.9159**	**6.2594**	**1.4170**	**0.9126**	**2.3296**	**0.0000**	**7,382.9060**	**7,382.9060**	**0.4208**	**0.0000**	**7,391.7436**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	78.7820	174.5806	828.6905	3.0599	196.3973	4.0719	200.4691	52.5371	3.7573	56.2945		227,577.4626	227,577.4626	7.2882		227,730.5143
Total	**577.8863**	**195.1944**	**1,754.3388**	**4.3800**	**196.3973**	**125.7193**	**322.1166**	**52.5371**	**125.3859**	**177.9231**	**14,743.5296**	**267,064.2017**	**281,807.7313**	**51.6918**	**1.2009**	**283,265.5347**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	78.7820	174.5806	828.6905	3.0599	196.3973	4.0719	200.4691	52.5371	3.7573	56.2945		227,577.4626	227,577.4626	7.2882		227,730.5143
Total	**577.8863**	**195.1944**	**1,754.3388**	**4.3800**	**196.3973**	**125.7193**	**322.1166**	**52.5371**	**125.3859**	**177.9231**	**14,743.5296**	**267,064.2017**	**281,807.7313**	**51.6918**	**1.2009**	**283,265.5347**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Architectural Coating 1	Architectural Coating	10/1/2017	11/1/2017	5	23	
2	Architectural Coating 2	Architectural Coating	1/1/2018	5/8/2018	5	92	
3	Architectural Coating 3	Architectural Coating	1/1/2019	6/24/2019	5	125	
4	Architectural Coating 4	Architectural Coating	1/1/2020	6/23/2020	5	125	
5	Architectural Coating 5	Architectural Coating	1/1/2021	2/16/2021	5	33	
6	Architectural Coating 6	Architectural Coating	1/1/2022	1/25/2022	5	17	
7	Architectural Coating 7	Architectural Coating	1/1/2023	1/11/2023	5	8	
8	Architectural Coating 8	Architectural Coating	1/1/2024	1/23/2024	5	17	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 3,736,530; Residential Outdoor: 1,245,510; Non-Residential Indoor: 2,318,201; Non-Residential Outdoor: 772,733 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating 1	Air Compressors	1	6.00	78	0.48
Architectural Coating 2	Air Compressors	1	6.00	78	0.48
Architectural Coating 3	Air Compressors	1	6.00	78	0.48
Architectural Coating 4	Air Compressors	1	6.00	78	0.48
Architectural Coating 5	Air Compressors	1	6.00	78	0.48
Architectural Coating 6	Air Compressors	1	6.00	78	0.48
Architectural Coating 7	Air Compressors	1	6.00	78	0.48
Architectural Coating 8	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating 1	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 2	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 3	1	77.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 4	1	130.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 5	1	34.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 6	1	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 7	1	9.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 8	1	14.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Architectural Coating 1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,184.7193					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.3323	2.1850	1.8681	2.9700e-003		0.1733	0.1733		0.1733	0.1733		281.4481	281.4481	0.0297		282.0721
Total	**2,185.0517**	**2.1850**	**1.8681**	**2.9700e-003**		**0.1733**	**0.1733**		**0.1733**	**0.1733**		**281.4481**	**281.4481**	**0.0297**		**282.0721**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1762	0.2604	3.2279	7.6000e-003	0.5870	5.2100e-003	0.5922	0.1557	4.8000e-003	0.1605		618.3123	618.3123	0.0321		618.9855
Total	**0.1762**	**0.2604**	**3.2279**	**7.6000e-003**	**0.5870**	**5.2100e-003**	**0.5922**	**0.1557**	**4.8000e-003**	**0.1605**		**618.3123**	**618.3123**	**0.0321**		**618.9855**

3.2 Architectural Coating 1 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,184.7193					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.3323	2.1850	1.8681	2.9700e-003		0.1733	0.1733		0.1733	0.1733	0.0000	281.4481	281.4481	0.0297		282.0721
Total	**2,185.0517**	**2.1850**	**1.8681**	**2.9700e-003**		**0.1733**	**0.1733**		**0.1733**	**0.1733**	**0.0000**	**281.4481**	**281.4481**	**0.0297**		**282.0721**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1762	0.2604	3.2279	7.6000e-003	0.5870	5.2100e-003	0.5922	0.1557	4.8000e-003	0.1605		618.3123	618.3123	0.0321		618.9855
Total	**0.1762**	**0.2604**	**3.2279**	**7.6000e-003**	**0.5870**	**5.2100e-003**	**0.5922**	**0.1557**	**4.8000e-003**	**0.1605**		**618.3123**	**618.3123**	**0.0321**		**618.9855**

3.3 Architectural Coating 2 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	546.1798					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506		281.4485	281.4485	0.0267		282.0102
Total	**546.4785**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**		**281.4485**	**281.4485**	**0.0267**		**282.0102**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1575	0.2364	2.9332	7.5900e-003	0.5870	5.0400e-003	0.5921	0.1557	4.6600e-003	0.1603		595.6844	595.6844	0.0298		596.3100
Total	**0.1575**	**0.2364**	**2.9332**	**7.5900e-003**	**0.5870**	**5.0400e-003**	**0.5921**	**0.1557**	**4.6600e-003**	**0.1603**		**595.6844**	**595.6844**	**0.0298**		**596.3100**

3.3 Architectural Coating 2 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	546.1798					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506	0.0000	281.4485	281.4485	0.0267		282.0102
Total	**546.4785**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**	**0.0000**	**281.4485**	**281.4485**	**0.0267**		**282.0102**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1575	0.2364	2.9332	7.5900e-003	0.5870	5.0400e-003	0.5921	0.1557	4.6600e-003	0.1603		595.6844	595.6844	0.0298		596.3100
Total	**0.1575**	**0.2364**	**2.9332**	**7.5900e-003**	**0.5870**	**5.0400e-003**	**0.5921**	**0.1557**	**4.6600e-003**	**0.1603**		**595.6844**	**595.6844**	**0.0298**		**596.3100**

3.4 Architectural Coating 3 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		281.9473
Total	**402.2548**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**281.9473**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2841	0.4281	5.3185	0.0149	1.1590	9.6900e-003	1.1687	0.3073	8.9800e-003	0.3163		1,129.9999	1,129.9999	0.0550		1,131.1549
Total	**0.2841**	**0.4281**	**5.3185**	**0.0149**	**1.1590**	**9.6900e-003**	**1.1687**	**0.3073**	**8.9800e-003**	**0.3163**		**1,129.9999**	**1,129.9999**	**0.0550**		**1,131.1549**

3.4 Architectural Coating 3 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		281.9473
Total	**402.2548**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**	**0.0000**	**281.4481**	**281.4481**	**0.0238**		**281.9473**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2841	0.4281	5.3185	0.0149	1.1590	9.6900e-003	1.1687	0.3073	8.9800e-003	0.3163		1,129.9999	1,129.9999	0.0550		1,131.1549
Total	**0.2841**	**0.4281**	**5.3185**	**0.0149**	**1.1590**	**9.6900e-003**	**1.1687**	**0.3073**	**8.9800e-003**	**0.3163**		**1,129.9999**	**1,129.9999**	**0.0550**		**1,131.1549**

3.5 Architectural Coating 4 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9057
Total	**402.2305**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9057**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4486	0.6704	8.3719	0.0252	1.9568	0.0162	1.9730	0.5189	0.0150	0.5339		1,831.2045	1,831.2045	0.0881		1,833.0536
Total	**0.4486**	**0.6704**	**8.3719**	**0.0252**	**1.9568**	**0.0162**	**1.9730**	**0.5189**	**0.0150**	**0.5339**		**1,831.2045**	**1,831.2045**	**0.0881**		**1,833.0536**

3.5 Architectural Coating 4 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9057
Total	**402.2305**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9057**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4486	0.6704	8.3719	0.0252	1.9568	0.0162	1.9730	0.5189	0.0150	0.5339		1,831.2045	1,831.2045	0.0881		1,833.0536
Total	**0.4486**	**0.6704**	**8.3719**	**0.0252**	**1.9568**	**0.0162**	**1.9730**	**0.5189**	**0.0150**	**0.5339**		**1,831.2045**	**1,831.2045**	**0.0881**		**1,833.0536**

3.6 Architectural Coating 5 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	1,522.6832					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.8537
Total	**1,522.9021**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.8537**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1108	0.1638	2.0576	6.6100e-003	0.5118	4.2100e-003	0.5160	0.1357	3.9100e-003	0.1396		471.4500	471.4500	0.0220		471.9128
Total	**0.1108**	**0.1638**	**2.0576**	**6.6100e-003**	**0.5118**	**4.2100e-003**	**0.5160**	**0.1357**	**3.9100e-003**	**0.1396**		**471.4500**	**471.4500**	**0.0220**		**471.9128**

3.6 Architectural Coating 5 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	1,522.6832					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.8537
Total	**1,522.9021**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.8537**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1108	0.1638	2.0576	6.6100e-003	0.5118	4.2100e-003	0.5160	0.1357	3.9100e-003	0.1396		471.4500	471.4500	0.0220		471.9128
Total	**0.1108**	**0.1638**	**2.0576**	**6.6100e-003**	**0.5118**	**4.2100e-003**	**0.5160**	**0.1357**	**3.9100e-003**	**0.1396**		**471.4500**	**471.4500**	**0.0220**		**471.9128**

3.7 Architectural Coating 6 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2045	1.4085	1.8136	2.9700e-003		0.0817	0.0817		0.0817	0.0817		281.4481	281.4481	0.0183		281.8329
Total	**2,956.0013**	**1.4085**	**1.8136**	**2.9700e-003**		**0.0817**	**0.0817**		**0.0817**	**0.0817**		**281.4481**	**281.4481**	**0.0183**		**281.8329**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0400	0.0587	0.7394	2.5300e-003	0.1957	1.6000e-003	0.1973	0.0519	1.4900e-003	0.0534		177.2675	177.2675	8.0700e-003		177.4369
Total	**0.0400**	**0.0587**	**0.7394**	**2.5300e-003**	**0.1957**	**1.6000e-003**	**0.1973**	**0.0519**	**1.4900e-003**	**0.0534**		**177.2675**	**177.2675**	**8.0700e-003**		**177.4369**

3.7 Architectural Coating 6 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2045	1.4085	1.8136	2.9700e-003		0.0817	0.0817		0.0817	0.0817	0.0000	281.4481	281.4481	0.0183		281.8329
Total	**2,956.0013**	**1.4085**	**1.8136**	**2.9700e-003**		**0.0817**	**0.0817**		**0.0817**	**0.0817**	**0.0000**	**281.4481**	**281.4481**	**0.0183**		**281.8329**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0400	0.0587	0.7394	2.5300e-003	0.1957	1.6000e-003	0.1973	0.0519	1.4900e-003	0.0534		177.2675	177.2675	8.0700e-003		177.4369
Total	**0.0400**	**0.0587**	**0.7394**	**2.5300e-003**	**0.1957**	**1.6000e-003**	**0.1973**	**0.0519**	**1.4900e-003**	**0.0534**		**177.2675**	**177.2675**	**8.0700e-003**		**177.4369**

3.8 Architectural Coating 7 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	6,281.0681					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1917	1.3030	1.8111	2.9700e-003		0.0708	0.0708		0.0708	0.0708		281.4481	281.4481	0.0168		281.8017
Total	**6,281.2598**	**1.3030**	**1.8111**	**2.9700e-003**		**0.0708**	**0.0708**		**0.0708**	**0.0708**		**281.4481**	**281.4481**	**0.0168**		**281.8017**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0262	0.0381	0.4816	1.7500e-003	0.1355	1.1000e-003	0.1366	0.0359	1.0200e-003	0.0370		120.8212	120.8212	5.3600e-003		120.9338
Total	**0.0262**	**0.0381**	**0.4816**	**1.7500e-003**	**0.1355**	**1.1000e-003**	**0.1366**	**0.0359**	**1.0200e-003**	**0.0370**		**120.8212**	**120.8212**	**5.3600e-003**		**120.9338**

3.8 Architectural Coating 7 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	6,281.0681					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1917	1.3030	1.8111	2.9700e-003		0.0708	0.0708		0.0708	0.0708	0.0000	281.4481	281.4481	0.0168		281.8017
Total	**6,281.2598**	**1.3030**	**1.8111**	**2.9700e-003**		**0.0708**	**0.0708**		**0.0708**	**0.0708**	**0.0000**	**281.4481**	**281.4481**	**0.0168**		**281.8017**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0262	0.0381	0.4816	1.7500e-003	0.1355	1.1000e-003	0.1366	0.0359	1.0200e-003	0.0370		120.8212	120.8212	5.3600e-003		120.9338
Total	**0.0262**	**0.0381**	**0.4816**	**1.7500e-003**	**0.1355**	**1.1000e-003**	**0.1366**	**0.0359**	**1.0200e-003**	**0.0370**		**120.8212**	**120.8212**	**5.3600e-003**		**120.9338**

3.9 Architectural Coating 8 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609		281.4481	281.4481	0.0159		281.7809
Total	**2,955.9775**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**		**281.4481**	**281.4481**	**0.0159**		**281.7809**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0387	0.0561	0.7124	2.7400e-003	0.2107	1.7300e-003	0.2125	0.0559	1.6100e-003	0.0575		186.5813	186.5813	8.1300e-003		186.7520
Total	**0.0387**	**0.0561**	**0.7124**	**2.7400e-003**	**0.2107**	**1.7300e-003**	**0.2125**	**0.0559**	**1.6100e-003**	**0.0575**		**186.5813**	**186.5813**	**8.1300e-003**		**186.7520**

3.9 Architectural Coating 8 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609	0.0000	281.4481	281.4481	0.0159		281.7809
Total	**2,955.9775**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**	**0.0000**	**281.4481**	**281.4481**	**0.0159**		**281.7809**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0387	0.0561	0.7124	2.7400e-003	0.2107	1.7300e-003	0.2125	0.0559	1.6100e-003	0.0575		186.5813	186.5813	8.1300e-003		186.7520
Total	**0.0387**	**0.0561**	**0.7124**	**2.7400e-003**	**0.2107**	**1.7300e-003**	**0.2125**	**0.0559**	**1.6100e-003**	**0.0575**		**186.5813**	**186.5813**	**8.1300e-003**		**186.7520**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	78.7820	174.5806	828.6905	3.0599	196.3973	4.0719	200.4691	52.5371	3.7573	56.2945		227,577.4626	227,577.4626	7.2882		227,730.5143
Unmitigated	78.7820	174.5806	828.6905	3.0599	196.3973	4.0719	200.4691	52.5371	3.7573	56.2945		227,577.4626	227,577.4626	7.2882		227,730.5143

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	25,622	25,622
Condo/Townhouse	4,613.00	5,012.00	4249.00	15,780,408	15,780,408
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	12,060,740	12,060,740
Elementary School	967.50	0.00	0.00	2,381,697	2,381,697
General Office Building	4,789.35	1,030.95	426.30	11,691,142	11,691,142
Health Club	82.33	52.18	66.83	162,126	162,126
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	25,081,204	25,081,204
Single Family Housing	3,244.23	3,417.12	2973.03	11,038,035	11,038,035
Strip Mall	664.80	630.60	306.45	1,158,150	1,158,150
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	79,379,125	79,379,125

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	16.60	8.40	6.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Elementary School	16.60	8.40	6.90	65.00	30.00	5.00	63	25	12
General Office Building	16.60	8.40	6.90	33.00	48.00	19.00	77	19	4
Health Club	16.60	8.40	6.90	16.90	64.10	19.00	52	39	9
Parking Lot	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	16.60	8.40	6.90	16.30	64.70	19.00	54	35	11
Single Family Housing	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Strip Mall	16.60	8.40	6.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Architectural Coating

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction run, no need to factor in RPS

Land Use - Based on Project Description provided by the Client

Construction Phase - Based on Client provided information.

Off-road Equipment -

Off-road Equipment -

Trips and VMT - From yearly analysis

On-road Fugitive Dust -

Architectural Coating - Updated to include Parking Lot SQFT for Architectural Coating

Vehicle Trips -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	764,802.00	772,733.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00

tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	2,294,405.00	2,318,201.00
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstructionPhase	NumDays	330.00	23.00
tblConstructionPhase	NumDays	330.00	92.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	125.00
tblConstructionPhase	NumDays	330.00	33.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	NumDays	330.00	8.00
tblConstructionPhase	NumDays	330.00	17.00
tblConstructionPhase	PhaseEndDate	3/9/2018	5/8/2018
tblConstructionPhase	PhaseEndDate	10/30/2018	6/24/2019
tblConstructionPhase	PhaseEndDate	12/16/2019	6/23/2020
tblConstructionPhase	PhaseEndDate	8/7/2020	2/16/2021
tblConstructionPhase	PhaseEndDate	3/11/2021	1/25/2022
tblConstructionPhase	PhaseEndDate	2/4/2022	1/11/2023
tblConstructionPhase	PhaseEndDate	2/3/2023	1/23/2024
tblConstructionPhase	PhaseStartDate	11/2/2017	1/1/2018
tblConstructionPhase	PhaseStartDate	5/9/2018	1/1/2019
tblConstructionPhase	PhaseStartDate	6/25/2019	1/1/2020
tblConstructionPhase	PhaseStartDate	6/24/2020	1/1/2021
tblConstructionPhase	PhaseStartDate	2/17/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	1/26/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	1/12/2023	1/1/2024
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53

tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	39.00
tblTripsAndVMT	WorkerTripNumber	316.00	77.00
tblTripsAndVMT	WorkerTripNumber	316.00	130.00
tblTripsAndVMT	WorkerTripNumber	316.00	34.00
tblTripsAndVMT	WorkerTripNumber	316.00	13.00
tblTripsAndVMT	WorkerTripNumber	316.00	9.00
tblTripsAndVMT	WorkerTripNumber	316.00	14.00
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40

tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CC_TL	10.10	8.40
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CNW_TL	7.90	6.90
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	CW_TL	18.50	16.60
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HO_TL	12.90	8.70
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HS_TL	9.60	5.90
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70
tblVehicleTrips	HW_TL	19.80	14.70

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	2,185.2328	2.4739	4.8604	0.0101	0.5870	0.1785	0.7656	0.1557	0.1781	0.3338	0.0000	864.8924	864.8924	0.0618	0.0000	866.1897
2018	546.6399	2.2680	4.5610	0.0101	0.5870	0.1556	0.7426	0.1557	0.1552	0.3109	0.0000	843.4963	843.4963	0.0565	0.0000	844.6835
2019	402.5458	2.3102	6.7346	0.0171	1.1590	0.1385	1.2975	0.3073	0.1378	0.4451	0.0000	1,347.5690	1,347.5690	0.0788	0.0000	1,349.2232
2020	402.6898	2.4271	9.5208	0.0267	1.9568	0.1271	2.0839	0.5189	0.1259	0.6448	0.0000	2,009.0092	2,009.0092	0.1098	0.0000	2,011.3159
2021	1,523.0155	1.7084	3.7045	9.2000e-003	0.5118	0.0983	0.6101	0.1357	0.0980	0.2337	0.0000	726.1772	726.1772	0.0414	0.0000	727.0457
2022	2,956.0423	1.4735	2.4906	5.3500e-003	0.1957	0.0833	0.2790	0.0519	0.0832	0.1351	0.0000	448.6555	448.6555	0.0264	0.0000	449.2097
2023	6,281.2865	1.3452	2.2514	4.6200e-003	0.1355	0.0719	0.2074	0.0359	0.0718	0.1078	0.0000	395.4030	395.4030	0.0222	0.0000	395.8692
2024	2,956.0171	1.2809	2.4603	5.5500e-003	0.2107	0.0627	0.2734	0.0559	0.0625	0.1184	0.0000	457.3966	457.3966	0.0240	0.0000	457.9000
Total	**17,253.4697**	**15.2872**	**36.5837**	**0.0888**	**5.3435**	**0.9159**	**6.2594**	**1.4170**	**0.9126**	**2.3296**	**0.0000**	**7,092.5993**	**7,092.5993**	**0.4208**	**0.0000**	**7,101.4369**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2017	2,185.2328	2.4739	4.8604	0.0101	0.5870	0.1785	0.7656	0.1557	0.1781	0.3338	0.0000	864.8924	864.8924	0.0618	0.0000	866.1897
2018	546.6399	2.2680	4.5610	0.0101	0.5870	0.1556	0.7426	0.1557	0.1552	0.3109	0.0000	843.4963	843.4963	0.0565	0.0000	844.6835
2019	402.5458	2.3102	6.7346	0.0171	1.1590	0.1385	1.2975	0.3073	0.1378	0.4451	0.0000	1,347.5690	1,347.5690	0.0788	0.0000	1,349.2232
2020	402.6898	2.4271	9.5208	0.0267	1.9568	0.1271	2.0839	0.5189	0.1259	0.6448	0.0000	2,009.0092	2,009.0092	0.1098	0.0000	2,011.3159
2021	1,523.0155	1.7084	3.7045	9.2000e-003	0.5118	0.0983	0.6101	0.1357	0.0980	0.2337	0.0000	726.1772	726.1772	0.0414	0.0000	727.0457
2022	2,956.0423	1.4735	2.4906	5.3500e-003	0.1957	0.0833	0.2790	0.0519	0.0832	0.1351	0.0000	448.6555	448.6555	0.0264	0.0000	449.2097
2023	6,281.2865	1.3452	2.2514	4.6200e-003	0.1355	0.0719	0.2074	0.0359	0.0718	0.1078	0.0000	395.4030	395.4030	0.0222	0.0000	395.8692
2024	2,956.0171	1.2809	2.4603	5.5500e-003	0.2107	0.0627	0.2734	0.0559	0.0625	0.1184	0.0000	457.3966	457.3966	0.0240	0.0000	457.9000
Total	**17,253.4697**	**15.2872**	**36.5837**	**0.0888**	**5.3435**	**0.9159**	**6.2594**	**1.4170**	**0.9126**	**2.3296**	**0.0000**	**7,092.5993**	**7,092.5993**	**0.4208**	**0.0000**	**7,101.4369**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	82.6062	183.6567	845.5007	2.9227	196.3973	4.0855	200.4828	52.5371	3.7699	56.3070		218,058.9303	218,058.9303	7.3008		218,212.2460
Total	**581.7105**	**204.2705**	**1,771.1490**	**4.2429**	**196.3973**	**125.7330**	**322.1303**	**52.5371**	**125.3985**	**177.9356**	**14,743.5296**	**257,545.6694**	**272,289.1990**	**51.7044**	**1.2009**	**273,747.2663**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	82.6062	183.6567	845.5007	2.9227	196.3973	4.0855	200.4828	52.5371	3.7699	56.3070		218,058.9303	218,058.9303	7.3008		218,212.2460
Total	**581.7105**	**204.2705**	**1,771.1490**	**4.2429**	**196.3973**	**125.7330**	**322.1303**	**52.5371**	**125.3985**	**177.9356**	**14,743.5296**	**257,545.6694**	**272,289.1990**	**51.7044**	**1.2009**	**273,747.2663**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Architectural Coating 1	Architectural Coating	10/1/2017	11/1/2017	5	23	
2	Architectural Coating 2	Architectural Coating	1/1/2018	5/8/2018	5	92	
3	Architectural Coating 3	Architectural Coating	1/1/2019	6/24/2019	5	125	
4	Architectural Coating 4	Architectural Coating	1/1/2020	6/23/2020	5	125	
5	Architectural Coating 5	Architectural Coating	1/1/2021	2/16/2021	5	33	
6	Architectural Coating 6	Architectural Coating	1/1/2022	1/25/2022	5	17	
7	Architectural Coating 7	Architectural Coating	1/1/2023	1/11/2023	5	8	
8	Architectural Coating 8	Architectural Coating	1/1/2024	1/23/2024	5	17	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 3,736,530; Residential Outdoor: 1,245,510; Non-Residential Indoor: 2,318,201; Non-Residential Outdoor: 772,733 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating 1	Air Compressors	1	6.00	78	0.48
Architectural Coating 2	Air Compressors	1	6.00	78	0.48
Architectural Coating 3	Air Compressors	1	6.00	78	0.48
Architectural Coating 4	Air Compressors	1	6.00	78	0.48
Architectural Coating 5	Air Compressors	1	6.00	78	0.48
Architectural Coating 6	Air Compressors	1	6.00	78	0.48
Architectural Coating 7	Air Compressors	1	6.00	78	0.48
Architectural Coating 8	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating 1	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 2	1	39.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 3	1	77.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 4	1	130.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 5	1	34.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 6	1	13.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 7	1	9.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating 8	1	14.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Architectural Coating 1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,184.7193					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.3323	2.1850	1.8681	2.9700e-003		0.1733	0.1733		0.1733	0.1733		281.4481	281.4481	0.0297		282.0721
Total	**2,185.0517**	**2.1850**	**1.8681**	**2.9700e-003**		**0.1733**	**0.1733**		**0.1733**	**0.1733**		**281.4481**	**281.4481**	**0.0297**		**282.0721**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1812	0.2889	2.9923	7.1600e-003	0.5870	5.2100e-003	0.5922	0.1557	4.8000e-003	0.1605		583.4444	583.4444	0.0321		584.1176
Total	**0.1812**	**0.2889**	**2.9923**	**7.1600e-003**	**0.5870**	**5.2100e-003**	**0.5922**	**0.1557**	**4.8000e-003**	**0.1605**		**583.4444**	**583.4444**	**0.0321**		**584.1176**

3.2 Architectural Coating 1 - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,184.7193					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.3323	2.1850	1.8681	2.9700e-003		0.1733	0.1733		0.1733	0.1733	0.0000	281.4481	281.4481	0.0297		282.0721
Total	**2,185.0517**	**2.1850**	**1.8681**	**2.9700e-003**		**0.1733**	**0.1733**		**0.1733**	**0.1733**	**0.0000**	**281.4481**	**281.4481**	**0.0297**		**282.0721**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1812	0.2889	2.9923	7.1600e-003	0.5870	5.2100e-003	0.5922	0.1557	4.8000e-003	0.1605		583.4444	583.4444	0.0321		584.1176
Total	**0.1812**	**0.2889**	**2.9923**	**7.1600e-003**	**0.5870**	**5.2100e-003**	**0.5922**	**0.1557**	**4.8000e-003**	**0.1605**		**583.4444**	**583.4444**	**0.0321**		**584.1176**

3.3 Architectural Coating 2 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	546.1798					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506		281.4485	281.4485	0.0267		282.0102
Total	**546.4785**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**		**281.4485**	**281.4485**	**0.0267**		**282.0102**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1615	0.2622	2.7068	7.1600e-003	0.5870	5.0400e-003	0.5921	0.1557	4.6600e-003	0.1603		562.0478	562.0478	0.0298		562.6734
Total	**0.1615**	**0.2622**	**2.7068**	**7.1600e-003**	**0.5870**	**5.0400e-003**	**0.5921**	**0.1557**	**4.6600e-003**	**0.1603**		**562.0478**	**562.0478**	**0.0298**		**562.6734**

3.3 Architectural Coating 2 - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	546.1798					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2986	2.0058	1.8542	2.9700e-003		0.1506	0.1506		0.1506	0.1506	0.0000	281.4485	281.4485	0.0267		282.0102
Total	**546.4785**	**2.0058**	**1.8542**	**2.9700e-003**		**0.1506**	**0.1506**		**0.1506**	**0.1506**	**0.0000**	**281.4485**	**281.4485**	**0.0267**		**282.0102**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1615	0.2622	2.7068	7.1600e-003	0.5870	5.0400e-003	0.5921	0.1557	4.6600e-003	0.1603		562.0478	562.0478	0.0298		562.6734
Total	**0.1615**	**0.2622**	**2.7068**	**7.1600e-003**	**0.5870**	**5.0400e-003**	**0.5921**	**0.1557**	**4.6600e-003**	**0.1603**		**562.0478**	**562.0478**	**0.0298**		**562.6734**

3.4 Architectural Coating 3 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		281.9473
Total	**402.2548**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**281.9473**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2910	0.4748	4.8933	0.0141	1.1590	9.6900e-003	1.1687	0.3073	8.9800e-003	0.3163		1,066.1210	1,066.1210	0.0550		1,067.2760
Total	**0.2910**	**0.4748**	**4.8933**	**0.0141**	**1.1590**	**9.6900e-003**	**1.1687**	**0.3073**	**8.9800e-003**	**0.3163**		**1,066.1210**	**1,066.1210**	**0.0550**		**1,067.2760**

3.4 Architectural Coating 3 - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		281.9473
Total	**402.2548**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**	**0.0000**	**281.4481**	**281.4481**	**0.0238**		**281.9473**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2910	0.4748	4.8933	0.0141	1.1590	9.6900e-003	1.1687	0.3073	8.9800e-003	0.3163		1,066.1210	1,066.1210	0.0550		1,067.2760
Total	**0.2910**	**0.4748**	**4.8933**	**0.0141**	**1.1590**	**9.6900e-003**	**1.1687**	**0.3073**	**8.9800e-003**	**0.3163**		**1,066.1210**	**1,066.1210**	**0.0550**		**1,067.2760**

3.5 Architectural Coating 4 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9057
Total	**402.2305**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9057**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4593	0.7433	7.6894	0.0238	1.9568	0.0162	1.9730	0.5189	0.0150	0.5339		1,727.5611	1,727.5611	0.0881		1,729.4103
Total	**0.4593**	**0.7433**	**7.6894**	**0.0238**	**1.9568**	**0.0162**	**1.9730**	**0.5189**	**0.0150**	**0.5339**		**1,727.5611**	**1,727.5611**	**0.0881**		**1,729.4103**

3.5 Architectural Coating 4 - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	401.9884					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9057
Total	**402.2305**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9057**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4593	0.7433	7.6894	0.0238	1.9568	0.0162	1.9730	0.5189	0.0150	0.5339		1,727.5611	1,727.5611	0.0881		1,729.4103
Total	**0.4593**	**0.7433**	**7.6894**	**0.0238**	**1.9568**	**0.0162**	**1.9730**	**0.5189**	**0.0150**	**0.5339**		**1,727.5611**	**1,727.5611**	**0.0881**		**1,729.4103**

3.6 Architectural Coating 5 - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	1,522.6832					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.8537
Total	**1,522.9021**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.8537**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1134	0.1815	1.8870	6.2300e-003	0.5118	4.2100e-003	0.5160	0.1357	3.9100e-003	0.1396		444.7292	444.7292	0.0220		445.1920
Total	**0.1134**	**0.1815**	**1.8870**	**6.2300e-003**	**0.5118**	**4.2100e-003**	**0.5160**	**0.1357**	**3.9100e-003**	**0.1396**		**444.7292**	**444.7292**	**0.0220**		**445.1920**

3.6 Architectural Coating 5 - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	1,522.6832					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.8537
Total	**1,522.9021**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.8537**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1134	0.1815	1.8870	6.2300e-003	0.5118	4.2100e-003	0.5160	0.1357	3.9100e-003	0.1396		444.7292	444.7292	0.0220		445.1920
Total	**0.1134**	**0.1815**	**1.8870**	**6.2300e-003**	**0.5118**	**4.2100e-003**	**0.5160**	**0.1357**	**3.9100e-003**	**0.1396**		**444.7292**	**444.7292**	**0.0220**		**445.1920**

3.7 Architectural Coating 6 - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2045	1.4085	1.8136	2.9700e-003		0.0817	0.0817		0.0817	0.0817		281.4481	281.4481	0.0183		281.8329
Total	**2,956.0013**	**1.4085**	**1.8136**	**2.9700e-003**		**0.0817**	**0.0817**		**0.0817**	**0.0817**		**281.4481**	**281.4481**	**0.0183**		**281.8329**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0410	0.0650	0.6770	2.3800e-003	0.1957	1.6000e-003	0.1973	0.0519	1.4900e-003	0.0534		167.2075	167.2075	8.0700e-003		167.3769
Total	**0.0410**	**0.0650**	**0.6770**	**2.3800e-003**	**0.1957**	**1.6000e-003**	**0.1973**	**0.0519**	**1.4900e-003**	**0.0534**		**167.2075**	**167.2075**	**8.0700e-003**		**167.3769**

3.7 Architectural Coating 6 - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2045	1.4085	1.8136	2.9700e-003		0.0817	0.0817		0.0817	0.0817	0.0000	281.4481	281.4481	0.0183		281.8329
Total	**2,956.0013**	**1.4085**	**1.8136**	**2.9700e-003**		**0.0817**	**0.0817**		**0.0817**	**0.0817**	**0.0000**	**281.4481**	**281.4481**	**0.0183**		**281.8329**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0410	0.0650	0.6770	2.3800e-003	0.1957	1.6000e-003	0.1973	0.0519	1.4900e-003	0.0534		167.2075	167.2075	8.0700e-003		167.3769
Total	**0.0410**	**0.0650**	**0.6770**	**2.3800e-003**	**0.1957**	**1.6000e-003**	**0.1973**	**0.0519**	**1.4900e-003**	**0.0534**		**167.2075**	**167.2075**	**8.0700e-003**		**167.3769**

3.8 Architectural Coating 7 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	6,281.0681					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1917	1.3030	1.8111	2.9700e-003		0.0708	0.0708		0.0708	0.0708		281.4481	281.4481	0.0168		281.8017
Total	**6,281.2598**	**1.3030**	**1.8111**	**2.9700e-003**		**0.0708**	**0.0708**		**0.0708**	**0.0708**		**281.4481**	**281.4481**	**0.0168**		**281.8017**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0268	0.0422	0.4403	1.6500e-003	0.1355	1.1000e-003	0.1366	0.0359	1.0200e-003	0.0370		113.9550	113.9550	5.3600e-003		114.0676
Total	**0.0268**	**0.0422**	**0.4403**	**1.6500e-003**	**0.1355**	**1.1000e-003**	**0.1366**	**0.0359**	**1.0200e-003**	**0.0370**		**113.9550**	**113.9550**	**5.3600e-003**		**114.0676**

3.8 Architectural Coating 7 - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	6,281.0681					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1917	1.3030	1.8111	2.9700e-003		0.0708	0.0708		0.0708	0.0708	0.0000	281.4481	281.4481	0.0168		281.8017
Total	**6,281.2598**	**1.3030**	**1.8111**	**2.9700e-003**		**0.0708**	**0.0708**		**0.0708**	**0.0708**	**0.0000**	**281.4481**	**281.4481**	**0.0168**		**281.8017**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0268	0.0422	0.4403	1.6500e-003	0.1355	1.1000e-003	0.1366	0.0359	1.0200e-003	0.0370		113.9550	113.9550	5.3600e-003		114.0676
Total	**0.0268**	**0.0422**	**0.4403**	**1.6500e-003**	**0.1355**	**1.1000e-003**	**0.1366**	**0.0359**	**1.0200e-003**	**0.0370**		**113.9550**	**113.9550**	**5.3600e-003**		**114.0676**

3.9 Architectural Coating 8 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609		281.4481	281.4481	0.0159		281.7809
Total	**2,955.9775**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**		**281.4481**	**281.4481**	**0.0159**		**281.7809**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0396	0.0621	0.6502	2.5800e-003	0.2107	1.7300e-003	0.2125	0.0559	1.6100e-003	0.0575		175.9485	175.9485	8.1300e-003		176.1192
Total	**0.0396**	**0.0621**	**0.6502**	**2.5800e-003**	**0.2107**	**1.7300e-003**	**0.2125**	**0.0559**	**1.6100e-003**	**0.0575**		**175.9485**	**175.9485**	**8.1300e-003**		**176.1192**

3.9 Architectural Coating 8 - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	2,955.7968					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1808	1.2188	1.8101	2.9700e-003		0.0609	0.0609		0.0609	0.0609	0.0000	281.4481	281.4481	0.0159		281.7809
Total	**2,955.9775**	**1.2188**	**1.8101**	**2.9700e-003**		**0.0609**	**0.0609**		**0.0609**	**0.0609**	**0.0000**	**281.4481**	**281.4481**	**0.0159**		**281.7809**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0396	0.0621	0.6502	2.5800e-003	0.2107	1.7300e-003	0.2125	0.0559	1.6100e-003	0.0575		175.9485	175.9485	8.1300e-003		176.1192
Total	**0.0396**	**0.0621**	**0.6502**	**2.5800e-003**	**0.2107**	**1.7300e-003**	**0.2125**	**0.0559**	**1.6100e-003**	**0.0575**		**175.9485**	**175.9485**	**8.1300e-003**		**176.1192**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	82.6062	183.6567	845.5007	2.9227	196.3973	4.0855	200.4828	52.5371	3.7699	56.3070		218,058.9303	218,058.9303	7.3008		218,212.2460
Unmitigated	82.6062	183.6567	845.5007	2.9227	196.3973	4.0855	200.4828	52.5371	3.7699	56.3070		218,058.9303	218,058.9303	7.3008		218,212.2460

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	25,622	25,622
Condo/Townhouse	4,613.00	5,012.00	4249.00	15,780,408	15,780,408
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	12,060,740	12,060,740
Elementary School	967.50	0.00	0.00	2,381,697	2,381,697
General Office Building	4,789.35	1,030.95	426.30	11,691,142	11,691,142
Health Club	82.33	52.18	66.83	162,126	162,126
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	25,081,204	25,081,204
Single Family Housing	3,244.23	3,417.12	2973.03	11,038,035	11,038,035
Strip Mall	664.80	630.60	306.45	1,158,150	1,158,150
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	79,379,125	79,379,125

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	16.60	8.40	6.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Elementary School	16.60	8.40	6.90	65.00	30.00	5.00	63	25	12
General Office Building	16.60	8.40	6.90	33.00	48.00	19.00	77	19	4
Health Club	16.60	8.40	6.90	16.90	64.10	19.00	52	39	9
Parking Lot	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	16.60	8.40	6.90	16.30	64.70	19.00	54	35	11
Single Family Housing	14.70	5.90	8.70	40.20	19.20	40.60	86	11	3
Strip Mall	16.60	8.40	6.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Site Prep, Grading & Paving - onsite trucks only

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00

tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00

tblOffRoadEquipment	UsageHours	8.00	6.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	8.00	2.00
tblTripsAndVMT	WorkerTripNumber	58.00	6.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0152	0.1303	0.0783	1.0000e-004	0.3207	0.0108	0.3315	0.0321	9.9400e-003	0.0420	0.0000	9.0286	9.0286	2.6100e-003	0.0000	9.0835
2016	2.7988	33.2740	19.6368	0.0271	13.3215	1.4839	14.8054	2.1857	1.3652	3.5509	0.0000	2,553.8757	2,553.8757	0.7677	0.0000	2,569.9970
2017	0.0607	0.2774	0.1665	2.2000e-004	0.1988	0.0183	0.2170	0.0198	0.0168	0.0366	0.0000	20.1090	20.1090	6.1100e-003	0.0000	20.2373
Total	**2.8746**	**33.6817**	**19.8816**	**0.0274**	**13.8410**	**1.5130**	**15.3540**	**2.2375**	**1.3919**	**3.6295**	**0.0000**	**2,583.0133**	**2,583.0133**	**0.7764**	**0.0000**	**2,599.3177**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.0152	0.1303	0.0783	1.0000e-004	0.3795	0.0108	0.3903	0.0379	9.9400e-003	0.0478	0.0000	9.0286	9.0286	2.6100e-003	0.0000	9.0834
2016	2.7988	33.2740	19.6368	0.0271	13.5702	1.4839	15.0541	1.6875	1.3652	3.0527	0.0000	2,553.8727	2,553.8727	0.7677	0.0000	2,569.9939
2017	0.0607	0.2774	0.1665	2.2000e-004	0.2435	0.0183	0.2617	0.0243	0.0168	0.0411	0.0000	20.1090	20.1090	6.1100e-003	0.0000	20.2373
Total	**2.8746**	**33.6817**	**19.8816**	**0.0274**	**14.1932**	**1.5130**	**15.7061**	**1.7496**	**1.3919**	**3.1415**	**0.0000**	**2,583.0103**	**2,583.0103**	**0.7764**	**0.0000**	**2,599.3147**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-2.54**	**0.00**	**-2.29**	**21.81**	**0.00**	**13.44**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6438**	**0.2703**	**50,832.7470**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6426**	**0.2701**	**50,832.6439**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	2.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	6.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving2	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0159	0.0000	0.0159	1.7200e-003	0.0000	1.7200e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1301	0.0761	9.0000e-005		0.0108	0.0108		9.9400e-003	9.9400e-003	0.0000	8.6876	8.6876	2.5900e-003	0.0000	8.7421
Total	**0.0151**	**0.1301**	**0.0761**	**9.0000e-005**	**0.0159**	**0.0108**	**0.0267**	**1.7200e-003**	**9.9400e-003**	**0.0117**	**0.0000**	**8.6876**	**8.6876**	**2.5900e-003**	**0.0000**	**8.7421**

3.2 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.1000e-004	2.2100e-003	0.0000	0.3048	0.0000	0.3048	0.0304	0.0000	0.0304	0.0000	0.3409	0.3409	2.0000e-005	0.0000	0.3414
Total	**1.3000e-004**	**2.1000e-004**	**2.2100e-003**	**0.0000**	**0.3048**	**0.0000**	**0.3048**	**0.0304**	**0.0000**	**0.0304**	**0.0000**	**0.3409**	**0.3409**	**2.0000e-005**	**0.0000**	**0.3414**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.2000e-003	0.0000	6.2000e-003	6.7000e-004	0.0000	6.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0151	0.1301	0.0761	9.0000e-005		0.0108	0.0108		9.9400e-003	9.9400e-003	0.0000	8.6876	8.6876	2.5900e-003	0.0000	8.7421
Total	**0.0151**	**0.1301**	**0.0761**	**9.0000e-005**	**6.2000e-003**	**0.0108**	**0.0170**	**6.7000e-004**	**9.9400e-003**	**0.0106**	**0.0000**	**8.6876**	**8.6876**	**2.5900e-003**	**0.0000**	**8.7421**

3.2 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-004	2.1000e-004	2.2100e-003	0.0000	0.3733	0.0000	0.3733	0.0372	0.0000	0.0372	0.0000	0.3409	0.3409	2.0000e-005	0.0000	0.3414
Total	**1.3000e-004**	**2.1000e-004**	**2.2100e-003**	**0.0000**	**0.3733**	**0.0000**	**0.3733**	**0.0372**	**0.0000**	**0.0372**	**0.0000**	**0.3409**	**0.3409**	**2.0000e-005**	**0.0000**	**0.3414**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0159	0.0000	0.0159	1.7200e-003	0.0000	1.7200e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4800e-003	0.0386	0.0231	3.0000e-005		3.2000e-003	3.2000e-003		2.9500e-003	2.9500e-003	0.0000	2.6150	2.6150	7.9000e-004	0.0000	2.6316
Total	**4.4800e-003**	**0.0386**	**0.0231**	**3.0000e-005**	**0.0159**	**3.2000e-003**	**0.0191**	**1.7200e-003**	**2.9500e-003**	**4.6700e-003**	**0.0000**	**2.6150**	**2.6150**	**7.9000e-004**	**0.0000**	**2.6316**

3.2 Site Preparation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	6.1000e-004	0.0000	0.0928	0.0000	0.0928	9.2400e-003	0.0000	9.2400e-003	0.0000	0.1003	0.1003	1.0000e-005	0.0000	0.1004
Total	**3.0000e-005**	**6.0000e-005**	**6.1000e-004**	**0.0000**	**0.0928**	**0.0000**	**0.0928**	**9.2400e-003**	**0.0000**	**9.2400e-003**	**0.0000**	**0.1003**	**0.1003**	**1.0000e-005**	**0.0000**	**0.1004**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.2000e-003	0.0000	6.2000e-003	6.7000e-004	0.0000	6.7000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4800e-003	0.0386	0.0231	3.0000e-005		3.2000e-003	3.2000e-003		2.9500e-003	2.9500e-003	0.0000	2.6150	2.6150	7.9000e-004	0.0000	2.6316
Total	**4.4800e-003**	**0.0386**	**0.0231**	**3.0000e-005**	**6.2000e-003**	**3.2000e-003**	**9.4000e-003**	**6.7000e-004**	**2.9500e-003**	**3.6200e-003**	**0.0000**	**2.6150**	**2.6150**	**7.9000e-004**	**0.0000**	**2.6316**

3.2 Site Preparation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	6.1000e-004	0.0000	0.1136	0.0000	0.1136	0.0113	0.0000	0.0113	0.0000	0.1003	0.1003	1.0000e-005	0.0000	0.1004
Total	**3.0000e-005**	**6.0000e-005**	**6.1000e-004**	**0.0000**	**0.1136**	**0.0000**	**0.1136**	**0.0113**	**0.0000**	**0.0113**	**0.0000**	**0.1003**	**0.1003**	**1.0000e-005**	**0.0000**	**0.1004**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.2738	0.0000	3.2738	1.1847	0.0000	1.1847	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7906	33.2291	19.5479	0.0269		1.4806	1.4806		1.3621	1.3621	0.0000	2,540.4145	2,540.4145	0.7663	0.0000	2,556.5064
Total	**2.7906**	**33.2291**	**19.5479**	**0.0269**	**3.2738**	**1.4806**	**4.7544**	**1.1847**	**1.3621**	**2.5469**	**0.0000**	**2,540.4145**	**2,540.4145**	**0.7663**	**0.0000**	**2,556.5064**

3.3 Grading - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7200e-003	6.3100e-003	0.0653	1.4000e-004	9.9391	1.0000e-004	9.9392	0.9900	1.0000e-004	0.9901	0.0000	10.7459	10.7459	6.0000e-004	0.0000	10.7586
Total	**3.7200e-003**	**6.3100e-003**	**0.0653**	**1.4000e-004**	**9.9391**	**1.0000e-004**	**9.9392**	**0.9900**	**1.0000e-004**	**0.9901**	**0.0000**	**10.7459**	**10.7459**	**6.0000e-004**	**0.0000**	**10.7586**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.2768	0.0000	1.2768	0.4621	0.0000	0.4621	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7906	33.2290	19.5478	0.0269		1.4806	1.4806		1.3621	1.3621	0.0000	2,540.4115	2,540.4115	0.7663	0.0000	2,556.5034
Total	**2.7906**	**33.2290**	**19.5478**	**0.0269**	**1.2768**	**1.4806**	**2.7574**	**0.4621**	**1.3621**	**1.8242**	**0.0000**	**2,540.4115**	**2,540.4115**	**0.7663**	**0.0000**	**2,556.5034**

3.3 Grading - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7200e-003	6.3100e-003	0.0653	1.4000e-004	12.1736	1.0000e-004	12.1737	1.2134	1.0000e-004	1.2135	0.0000	10.7459	10.7459	6.0000e-004	0.0000	10.7586
Total	**3.7200e-003**	**6.3100e-003**	**0.0653**	**1.4000e-004**	**12.1736**	**1.0000e-004**	**12.1737**	**1.2134**	**1.0000e-004**	**1.2135**	**0.0000**	**10.7459**	**10.7459**	**6.0000e-004**	**0.0000**	**10.7586**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

3.4 Paving1 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	5.9000e-004	0.0000	0.0994	0.0000	0.0994	9.9000e-003	0.0000	9.9000e-003	0.0000	0.1034	0.1034	1.0000e-005	0.0000	0.1036
Total	**3.0000e-005**	**6.0000e-005**	**5.9000e-004**	**0.0000**	**0.0994**	**0.0000**	**0.0994**	**9.9000e-003**	**0.0000**	**9.9000e-003**	**0.0000**	**0.1034**	**0.1034**	**1.0000e-005**	**0.0000**	**0.1036**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

3.4 Paving1 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	5.9000e-004	0.0000	0.1217	0.0000	0.1217	0.0121	0.0000	0.0121	0.0000	0.1034	0.1034	1.0000e-005	0.0000	0.1036
Total	**3.0000e-005**	**6.0000e-005**	**5.9000e-004**	**0.0000**	**0.1217**	**0.0000**	**0.1217**	**0.0121**	**0.0000**	**0.0121**	**0.0000**	**0.1034**	**0.1034**	**1.0000e-005**	**0.0000**	**0.1036**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

3.5 Paving2 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	5.9000e-004	0.0000	0.0994	0.0000	0.0994	9.9000e-003	0.0000	9.9000e-003	0.0000	0.1034	0.1034	1.0000e-005	0.0000	0.1036
Total	**3.0000e-005**	**6.0000e-005**	**5.9000e-004**	**0.0000**	**0.0994**	**0.0000**	**0.0994**	**9.9000e-003**	**0.0000**	**9.9000e-003**	**0.0000**	**0.1034**	**0.1034**	**1.0000e-005**	**0.0000**	**0.1036**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0144	0.1387	0.0827	1.1000e-004		9.1200e-003	9.1200e-003		8.3900e-003	8.3900e-003	0.0000	9.9511	9.9511	3.0500e-003	0.0000	10.0151
Paving	0.0159					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0303**	**0.1387**	**0.0827**	**1.1000e-004**		**9.1200e-003**	**9.1200e-003**		**8.3900e-003**	**8.3900e-003**	**0.0000**	**9.9511**	**9.9511**	**3.0500e-003**	**0.0000**	**10.0151**

3.5 Paving2 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	6.0000e-005	5.9000e-004	0.0000	0.1217	0.0000	0.1217	0.0121	0.0000	0.0121	0.0000	0.1034	0.1034	1.0000e-005	0.0000	0.1036
Total	**3.0000e-005**	**6.0000e-005**	**5.9000e-004**	**0.0000**	**0.1217**	**0.0000**	**0.1217**	**0.0121**	**0.0000**	**0.0121**	**0.0000**	**0.1034**	**0.1034**	**1.0000e-005**	**0.0000**	**0.1036**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Unmitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	385.8858	22.8052	0.0000	864.7950
Unmitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Site Prep, Grading & Paving - onsite trucks only

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00

tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00

tblOffRoadEquipment	UsageHours	8.00	6.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	8.00	2.00
tblTripsAndVMT	WorkerTripNumber	58.00	6.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	1.3204	11.3271	6.8182	8.3100e-003	30.1987	0.9396	31.1383	3.0167	0.8644	3.8811	0.0000	866.8161	866.8161	0.2505	0.0000	872.0773
2016	22.3548	265.8767	156.9309	0.2167	113.6051	11.8456	125.4507	18.1844	10.8979	29.0823	0.0000	22,501.4452	22,501.4452	6.7628	0.0000	22,643.4631
2017	4.0436	18.4936	11.1036	0.0145	14.5691	1.2168	15.7859	1.4511	1.1194	2.5705	0.0000	1,478.4117	1,478.4117	0.4490	0.0000	1,487.8395
Total	**27.7188**	**295.6974**	**174.8527**	**0.2395**	**158.3729**	**14.0019**	**172.3748**	**22.6521**	**12.8817**	**35.5339**	**0.0000**	**24,846.6729**	**24,846.6729**	**7.4622**	**0.0000**	**25,003.3799**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	1.3204	11.3271	6.8182	8.3100e-003	36.1028	0.9396	37.0424	3.6019	0.8644	4.4663	0.0000	866.8161	866.8161	0.2505	0.0000	872.0773
2016	22.3548	265.8767	156.9309	0.2167	117.2819	11.8456	129.1274	14.3682	10.8979	25.2661	0.0000	22,501.4452	22,501.4452	6.7628	0.0000	22,643.4631
2017	4.0436	18.4936	11.1036	0.0145	17.8446	1.2168	19.0613	1.7786	1.1194	2.8980	0.0000	1,478.4117	1,478.4117	0.4490	0.0000	1,487.8395
Total	**27.7188**	**295.6974**	**174.8527**	**0.2395**	**171.2293**	**14.0019**	**185.2311**	**19.7487**	**12.8817**	**32.6304**	**0.0000**	**24,846.6729**	**24,846.6729**	**7.4622**	**0.0000**	**25,003.3799**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-8.12**	**0.00**	**-7.46**	**12.82**	**0.00**	**8.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	2.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	6.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving2	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642		832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**1.0605**	**0.9393**	**1.9998**	**0.1145**	**0.8642**	**0.9787**		**832.7380**	**832.7380**	**0.2486**		**837.9588**

3.2 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0113	0.0163	0.2014	3.9000e-004	29.1382	2.9000e-004	29.1385	2.9022	2.7000e-004	2.9024		34.0780	34.0780	1.9300e-003		34.1185
Total	**0.0113**	**0.0163**	**0.2014**	**3.9000e-004**	**29.1382**	**2.9000e-004**	**29.1385**	**2.9022**	**2.7000e-004**	**2.9024**		**34.0780**	**34.0780**	**1.9300e-003**		**34.1185**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642	0.0000	832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**0.4136**	**0.9393**	**1.3529**	**0.0447**	**0.8642**	**0.9088**	**0.0000**	**832.7380**	**832.7380**	**0.2486**		**837.9588**

3.2 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0113	0.0163	0.2014	3.9000e-004	35.6892	2.9000e-004	35.6895	3.5573	2.7000e-004	3.5575		34.0780	34.0780	1.9300e-003		34.1185
Total	**0.0113**	**0.0163**	**0.2014**	**3.9000e-004**	**35.6892**	**2.9000e-004**	**35.6895**	**3.5573**	**2.7000e-004**	**3.5575**		**34.0780**	**34.0780**	**1.9300e-003**		**34.1185**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421		823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**1.0605**	**0.9153**	**1.9758**	**0.1145**	**0.8421**	**0.9566**		**823.5941**	**823.5941**	**0.2484**		**828.8110**

3.2 Site Preparation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0101	0.0148	0.1827	3.9000e-004	29.1382	2.8000e-004	29.1385	2.9022	2.6000e-004	2.9024		32.9413	32.9413	1.7800e-003		32.9786
Total	**0.0101**	**0.0148**	**0.1827**	**3.9000e-004**	**29.1382**	**2.8000e-004**	**29.1385**	**2.9022**	**2.6000e-004**	**2.9024**		**32.9413**	**32.9413**	**1.7800e-003**		**32.9786**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421	0.0000	823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**0.4136**	**0.9153**	**1.3289**	**0.0447**	**0.8421**	**0.8867**	**0.0000**	**823.5941**	**823.5941**	**0.2484**		**828.8110**

3.2 Site Preparation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0101	0.0148	0.1827	3.9000e-004	35.6892	2.8000e-004	35.6895	3.5573	2.6000e-004	3.5575		32.9413	32.9413	1.7800e-003		32.9786
Total	**0.0101**	**0.0148**	**0.1827**	**3.9000e-004**	**35.6892**	**2.8000e-004**	**35.6895**	**3.5573**	**2.6000e-004**	**3.5575**		**32.9413**	**32.9413**	**1.7800e-003**		**32.9786**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					26.1905	0.0000	26.1905	9.4779	0.0000	9.4779			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971		22,402.6214	22,402.6214	6.7574		22,544.5274
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**26.1905**	**11.8447**	**38.0352**	**9.4779**	**10.8971**	**20.3751**		**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5274**

3.3 Grading - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0304	0.0443	0.5481	1.1700e-003	87.4146	8.4000e-004	87.4155	8.7065	7.7000e-004	8.7072		98.8238	98.8238	5.3300e-003		98.9358
Total	**0.0304**	**0.0443**	**0.5481**	**1.1700e-003**	**87.4146**	**8.4000e-004**	**87.4155**	**8.7065**	**7.7000e-004**	**8.7072**		**98.8238**	**98.8238**	**5.3300e-003**		**98.9358**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					10.2143	0.0000	10.2143	3.6964	0.0000	3.6964			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971	0.0000	22,402.6214	22,402.6214	6.7574		22,544.5273
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**10.2143**	**11.8447**	**22.0590**	**3.6964**	**10.8971**	**14.5935**	**0.0000**	**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5273**

3.3 Grading - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0304	0.0443	0.5481	1.1700e-003	107.0676	8.4000e-004	107.0684	10.6718	7.7000e-004	10.6725		98.8238	98.8238	5.3300e-003		98.9358
Total	**0.0304**	**0.0443**	**0.5481**	**1.1700e-003**	**107.0676**	**8.4000e-004**	**107.0684**	**10.6718**	**7.7000e-004**	**10.6725**		**98.8238**	**98.8238**	**5.3300e-003**		**98.9358**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.4 Paving1 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.5200e-003	6.6800e-003	0.0828	1.9000e-004	14.5691	1.3000e-004	14.5692	1.4511	1.2000e-004	1.4512		15.8542	15.8542	8.2000e-004		15.8714
Total	**4.5200e-003**	**6.6800e-003**	**0.0828**	**1.9000e-004**	**14.5691**	**1.3000e-004**	**14.5692**	**1.4511**	**1.2000e-004**	**1.4512**		**15.8542**	**15.8542**	**8.2000e-004**		**15.8714**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.4 Paving1 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.5200e-003	6.6800e-003	0.0828	1.9000e-004	17.8446	1.3000e-004	17.8447	1.7786	1.2000e-004	1.7788		15.8542	15.8542	8.2000e-004		15.8714
Total	**4.5200e-003**	**6.6800e-003**	**0.0828**	**1.9000e-004**	**17.8446**	**1.3000e-004**	**17.8447**	**1.7786**	**1.2000e-004**	**1.7788**		**15.8542**	**15.8542**	**8.2000e-004**		**15.8714**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.5 Paving2 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.5200e-003	6.6800e-003	0.0828	1.9000e-004	14.5691	1.3000e-004	14.5692	1.4511	1.2000e-004	1.4512		15.8542	15.8542	8.2000e-004		15.8714
Total	**4.5200e-003**	**6.6800e-003**	**0.0828**	**1.9000e-004**	**14.5691**	**1.3000e-004**	**14.5692**	**1.4511**	**1.2000e-004**	**1.4512**		**15.8542**	**15.8542**	**8.2000e-004**		**15.8714**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.5 Paving2 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.5200e-003	6.6800e-003	0.0828	1.9000e-004	17.8446	1.3000e-004	17.8447	1.7786	1.2000e-004	1.7788		15.8542	15.8542	8.2000e-004		15.8714
Total	**4.5200e-003**	**6.6800e-003**	**0.0828**	**1.9000e-004**	**17.8446**	**1.3000e-004**	**17.8447**	**1.7786**	**1.2000e-004**	**1.7788**		**15.8542**	**15.8542**	**8.2000e-004**		**15.8714**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Unmitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Construction Emissions - Site Prep, Grading & Paving - onsite trucks only

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Land Use Type, Unit Amount, and Population based on Newhall provided information.

Construction Phase - Client provided - days of construction phase

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided equipment list

Off-road Equipment - Client provided

Off-road Equipment - Client Provided

Off-road Equipment - Client Provided

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as vendor trips, operate on 100% unpaved area

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstructionPhase	NumDays	465.00	250.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	330.00	15.00
tblConstructionPhase	NumDays	180.00	30.00
tblConstructionPhase	PhaseEndDate	1/16/2017	3/10/2017
tblConstructionPhase	PhaseEndDate	3/31/2017	9/1/2017
tblConstructionPhase	PhaseStartDate	12/27/2016	2/20/2017
tblConstructionPhase	PhaseStartDate	3/11/2017	8/14/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	125.00	89.00

tblOffRoadEquipment	HorsePower	125.00	89.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	130.00	82.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	80.00	84.00
tblOffRoadEquipment	HorsePower	255.00	358.00
tblOffRoadEquipment	HorsePower	361.00	356.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	208.00	82.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	174.00	162.00
tblOffRoadEquipment	HorsePower	400.00	381.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	8.00	1.60
tblOffRoadEquipment	UsageHours	8.00	20.00
tblOffRoadEquipment	UsageHours	8.00	4.00

tblOffRoadEquipment	UsageHours	8.00	6.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	WorkerTripNumber	8.00	2.00
tblTripsAndVMT	WorkerTripNumber	58.00	6.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00
tblTripsAndVMT	WorkerTripNumber	10.00	1.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	1.3207	11.3289	6.8049	8.2800e-003	30.1987	0.9396	31.1383	3.0167	0.8644	3.8811	0.0000	864.8983	864.8983	0.2505	0.0000	870.1595
2016	22.3557	265.8815	156.8931	0.2166	113.6051	11.8456	125.4507	18.1844	10.8979	29.0823	0.0000	22,495.8794	22,495.8794	6.7628	0.0000	22,637.8973
2017	4.0438	18.4944	11.0976	0.0145	14.5691	1.2168	15.7859	1.4511	1.1194	2.5705	0.0000	1,477.5176	1,477.5176	0.4490	0.0000	1,486.9455
Total	**27.7202**	**295.7048**	**174.7956**	**0.2394**	**158.3729**	**14.0019**	**172.3748**	**22.6521**	**12.8817**	**35.5339**	**0.0000**	**24,838.2953**	**24,838.2953**	**7.4622**	**0.0000**	**24,995.0023**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	1.3207	11.3289	6.8049	8.2800e-003	36.1028	0.9396	37.0424	3.6019	0.8644	4.4663	0.0000	864.8983	864.8983	0.2505	0.0000	870.1595
2016	22.3557	265.8815	156.8931	0.2166	117.2819	11.8456	129.1274	14.3682	10.8979	25.2661	0.0000	22,495.8793	22,495.8793	6.7628	0.0000	22,637.8973
2017	4.0438	18.4944	11.0976	0.0145	17.8446	1.2168	19.0613	1.7786	1.1194	2.8980	0.0000	1,477.5176	1,477.5176	0.4490	0.0000	1,486.9455
Total	**27.7202**	**295.7048**	**174.7956**	**0.2394**	**171.2293**	**14.0019**	**185.2311**	**19.7487**	**12.8817**	**32.6304**	**0.0000**	**24,838.2952**	**24,838.2952**	**7.4622**	**0.0000**	**24,995.0023**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-8.12**	**0.00**	**-7.46**	**12.82**	**0.00**	**8.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	12/1/2015	1/11/2016	5	30	
2	Grading	Grading	1/12/2016	12/26/2016	5	250	
3	Paving1	Paving	2/20/2017	3/10/2017	5	15	
4	Paving2	Paving	8/14/2017	9/1/2017	5	15	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 2625

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Crawler Tractors	2	8.00	82	0.43
Site Preparation	Tractors/Loaders/Backhoes	1	6.00	75	0.37
Grading	Crawler Tractors	4	8.00	82	0.43
Grading	Excavators	1	1.60	157	0.38
Grading	Graders	1	8.00	162	0.41
Grading	Off-Highway Trucks	1	4.00	381	0.38
Grading	Other Material Handling Equipment	6	8.00	196	0.40
Grading	Rubber Tired Dozers	1	20.00	358	0.40
Grading	Scrapers	8	8.00	356	0.48
Grading	Tractors/Loaders/Backhoes	1	4.00	75	0.37
Paving1	Graders	1	8.00	162	0.41
Paving1	Pavers	1	8.00	89	0.42
Paving1	Paving Equipment	1	8.00	82	0.36
Paving1	Rollers	1	8.00	84	0.38
Paving2	Graders	1	8.00	162	0.41
Paving2	Pavers	1	8.00	89	0.42
Paving2	Paving Equipment	1	8.00	82	0.36
Paving2	Rollers	1	8.00	84	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	3	2.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	23	6.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving1	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving2	4	1.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642		832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**1.0605**	**0.9393**	**1.9998**	**0.1145**	**0.8642**	**0.9787**		**832.7380**	**832.7380**	**0.2486**		**837.9588**

3.2 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0117	0.0181	0.1881	3.7000e-004	29.1382	2.9000e-004	29.1385	2.9022	2.7000e-004	2.9024		32.1603	32.1603	1.9300e-003		32.2007
Total	**0.0117**	**0.0181**	**0.1881**	**3.7000e-004**	**29.1382**	**2.9000e-004**	**29.1385**	**2.9022**	**2.7000e-004**	**2.9024**		**32.1603**	**32.1603**	**1.9300e-003**		**32.2007**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.3091	11.3108	6.6168	7.9200e-003		0.9393	0.9393		0.8642	0.8642	0.0000	832.7380	832.7380	0.2486		837.9588
Total	**1.3091**	**11.3108**	**6.6168**	**7.9200e-003**	**0.4136**	**0.9393**	**1.3529**	**0.0447**	**0.8642**	**0.9088**	**0.0000**	**832.7380**	**832.7380**	**0.2486**		**837.9588**

3.2 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0117	0.0181	0.1881	3.7000e-004	35.6892	2.9000e-004	35.6895	3.5573	2.7000e-004	3.5575		32.1603	32.1603	1.9300e-003		32.2007
Total	**0.0117**	**0.0181**	**0.1881**	**3.7000e-004**	**35.6892**	**2.9000e-004**	**35.6895**	**3.5573**	**2.7000e-004**	**3.5575**		**32.1603**	**32.1603**	**1.9300e-003**		**32.2007**

3.2 Site Preparation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.0605	0.0000	1.0605	0.1145	0.0000	0.1145			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421		823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**1.0605**	**0.9153**	**1.9758**	**0.1145**	**0.8421**	**0.9566**		**823.5941**	**823.5941**	**0.2484**		**828.8110**

3.2 Site Preparation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0104	0.0164	0.1701	3.7000e-004	29.1382	2.8000e-004	29.1385	2.9022	2.6000e-004	2.9024		31.0860	31.0860	1.7800e-003		31.1233
Total	**0.0104**	**0.0164**	**0.1701**	**3.7000e-004**	**29.1382**	**2.8000e-004**	**29.1385**	**2.9022**	**2.6000e-004**	**2.9024**		**31.0860**	**31.0860**	**1.7800e-003**		**31.1233**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.4136	0.0000	0.4136	0.0447	0.0000	0.0447			0.0000			0.0000
Off-Road	1.2786	11.0241	6.6048	7.9100e-003		0.9153	0.9153		0.8421	0.8421	0.0000	823.5941	823.5941	0.2484		828.8110
Total	**1.2786**	**11.0241**	**6.6048**	**7.9100e-003**	**0.4136**	**0.9153**	**1.3289**	**0.0447**	**0.8421**	**0.8867**	**0.0000**	**823.5941**	**823.5941**	**0.2484**		**828.8110**

3.2 Site Preparation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0104	0.0164	0.1701	3.7000e-004	35.6892	2.8000e-004	35.6895	3.5573	2.6000e-004	3.5575		31.0860	31.0860	1.7800e-003		31.1233
Total	**0.0104**	**0.0164**	**0.1701**	**3.7000e-004**	**35.6892**	**2.8000e-004**	**35.6895**	**3.5573**	**2.6000e-004**	**3.5575**		**31.0860**	**31.0860**	**1.7800e-003**		**31.1233**

3.3 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					26.1905	0.0000	26.1905	9.4779	0.0000	9.4779			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971		22,402.6214	22,402.6214	6.7574		22,544.5274
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**26.1905**	**11.8447**	**38.0352**	**9.4779**	**10.8971**	**20.3751**		**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5274**

3.3 Grading - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0313	0.0491	0.5102	1.1000e-003	87.4146	8.4000e-004	87.4155	8.7065	7.7000e-004	8.7072		93.2579	93.2579	5.3300e-003		93.3699
Total	**0.0313**	**0.0491**	**0.5102**	**1.1000e-003**	**87.4146**	**8.4000e-004**	**87.4155**	**8.7065**	**7.7000e-004**	**8.7072**		**93.2579**	**93.2579**	**5.3300e-003**		**93.3699**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					10.2143	0.0000	10.2143	3.6964	0.0000	3.6964			0.0000			0.0000
Off-Road	22.3244	265.8324	156.3828	0.2155		11.8447	11.8447		10.8971	10.8971	0.0000	22,402.6214	22,402.6214	6.7574		22,544.5273
Total	**22.3244**	**265.8324**	**156.3828**	**0.2155**	**10.2143**	**11.8447**	**22.0590**	**3.6964**	**10.8971**	**14.5935**	**0.0000**	**22,402.6214**	**22,402.6214**	**6.7574**		**22,544.5273**

3.3 Grading - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0313	0.0491	0.5102	1.1000e-003	107.0676	8.4000e-004	107.0684	10.6718	7.7000e-004	10.6725		93.2579	93.2579	5.3300e-003		93.3699
Total	**0.0313**	**0.0491**	**0.5102**	**1.1000e-003**	**107.0676**	**8.4000e-004**	**107.0684**	**10.6718**	**7.7000e-004**	**10.6725**		**93.2579**	**93.2579**	**5.3300e-003**		**93.3699**

3.4 Paving1 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.4 Paving1 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.6400e-003	7.4100e-003	0.0767	1.8000e-004	14.5691	1.3000e-004	14.5692	1.4511	1.2000e-004	1.4512		14.9601	14.9601	8.2000e-004		14.9774
Total	**4.6400e-003**	**7.4100e-003**	**0.0767**	**1.8000e-004**	**14.5691**	**1.3000e-004**	**14.5692**	**1.4511**	**1.2000e-004**	**1.4512**		**14.9601**	**14.9601**	**8.2000e-004**		**14.9774**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.4 Paving1 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.6400e-003	7.4100e-003	0.0767	1.8000e-004	17.8446	1.3000e-004	17.8447	1.7786	1.2000e-004	1.7788		14.9601	14.9601	8.2000e-004		14.9774
Total	**4.6400e-003**	**7.4100e-003**	**0.0767**	**1.8000e-004**	**17.8446**	**1.3000e-004**	**17.8447**	**1.7786**	**1.2000e-004**	**1.7788**		**14.9601**	**14.9601**	**8.2000e-004**		**14.9774**

3.5 Paving2 - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193		1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**		**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.5 Paving2 - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.6400e-003	7.4100e-003	0.0767	1.8000e-004	14.5691	1.3000e-004	14.5692	1.4511	1.2000e-004	1.4512		14.9601	14.9601	8.2000e-004		14.9774
Total	**4.6400e-003**	**7.4100e-003**	**0.0767**	**1.8000e-004**	**14.5691**	**1.3000e-004**	**14.5692**	**1.4511**	**1.2000e-004**	**1.4512**		**14.9601**	**14.9601**	**8.2000e-004**		**14.9774**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9187	18.4869	11.0209	0.0143		1.2166	1.2166		1.1193	1.1193	0.0000	1,462.5575	1,462.5575	0.4481		1,471.9681
Paving	2.1205					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0391**	**18.4869**	**11.0209**	**0.0143**		**1.2166**	**1.2166**		**1.1193**	**1.1193**	**0.0000**	**1,462.5575**	**1,462.5575**	**0.4481**		**1,471.9681**

3.5 Paving2 - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.6400e-003	7.4100e-003	0.0767	1.8000e-004	17.8446	1.3000e-004	17.8447	1.7786	1.2000e-004	1.7788		14.9601	14.9601	8.2000e-004		14.9774
Total	**4.6400e-003**	**7.4100e-003**	**0.0767**	**1.8000e-004**	**17.8446**	**1.3000e-004**	**17.8447**	**1.7786**	**1.2000e-004**	**1.7788**		**14.9601**	**14.9601**	**8.2000e-004**		**14.9774**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Unmitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Const Emissions - Utility Inst & Bldg Const - Onsite Truck

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Client Provided - All Construction Phases (utility installation dates shifted)

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as worker trips is assumed to operate on 100% unpaved area with a speed of 10 mph.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstructionPhase	NumDays	4,650.00	1,979.00

tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	13.00	4.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.0642	0.7142	0.4660	7.8000e-004	1.9878	0.0378	2.0256	0.1980	0.0347	0.2327	0.0000	73.2732	73.2732	0.0216	0.0000	73.7263
2017	0.3189	2.9204	2.0191	3.1300e-003	2.7829	0.1830	2.9659	0.2772	0.1709	0.4481	0.0000	282.8880	282.8880	0.0750	0.0000	284.4624
2018	0.3483	3.0355	2.2880	3.5000e-003	0.0000	0.1950	0.1950	0.0000	0.1833	0.1833	0.0000	308.9844	308.9844	0.0756	0.0000	310.5723
2019	0.3069	2.7359	2.2342	3.5000e-003	0.0000	0.1677	0.1677	0.0000	0.1577	0.1577	0.0000	305.5302	305.5302	0.0743	0.0000	307.0913
2020	0.2766	2.5000	2.2019	3.5100e-003	0.0000	0.1458	0.1458	0.0000	0.1371	0.1371	0.0000	302.1514	302.1514	0.0736	0.0000	303.6973
2021	0.2471	2.2629	2.1582	3.5000e-003	0.0000	0.1246	0.1246	0.0000	0.1172	0.1172	0.0000	301.0339	301.0339	0.0725	0.0000	302.5568
2022	0.2209	2.0197	2.1226	3.4900e-003	0.0000	0.1047	0.1047	0.0000	0.0986	0.0986	0.0000	299.9946	299.9946	0.0718	0.0000	301.5017
2023	0.2036	1.8606	2.1072	3.4900e-003	0.0000	0.0906	0.0906	0.0000	0.0852	0.0852	0.0000	300.0980	300.0980	0.0713	0.0000	301.5949
2024	0.1920	1.7524	2.1135	3.5200e-003	0.0000	0.0800	0.0800	0.0000	0.0752	0.0752	0.0000	302.4646	302.4646	0.0714	0.0000	303.9643
Total	**2.1783**	**19.8018**	**17.7107**	**0.0284**	**4.7708**	**1.1291**	**5.8999**	**0.4752**	**1.0600**	**1.5351**	**0.0000**	**2,476.4182**	**2,476.4182**	**0.6071**	**0.0000**	**2,489.1673**

2.1 Overall Construction

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2016	0.0642	0.7142	0.4660	7.8000e-004	2.4347	0.0378	2.4725	0.2427	0.0347	0.2774	0.0000	73.2731	73.2731	0.0216	0.0000	73.7262
2017	0.3189	2.9204	2.0191	3.1300e-003	3.4086	0.1830	3.5916	0.3398	0.1709	0.5107	0.0000	282.8876	282.8876	0.0750	0.0000	284.4621
2018	0.3483	3.0355	2.2880	3.5000e-003	0.0000	0.1950	0.1950	0.0000	0.1833	0.1833	0.0000	308.9841	308.9841	0.0756	0.0000	310.5720
2019	0.3069	2.7359	2.2342	3.5000e-003	0.0000	0.1677	0.1677	0.0000	0.1577	0.1577	0.0000	305.5299	305.5299	0.0743	0.0000	307.0909
2020	0.2766	2.5000	2.2019	3.5100e-003	0.0000	0.1458	0.1458	0.0000	0.1371	0.1371	0.0000	302.1510	302.1510	0.0736	0.0000	303.6969
2021	0.2471	2.2629	2.1582	3.5000e-003	0.0000	0.1246	0.1246	0.0000	0.1172	0.1172	0.0000	301.0335	301.0335	0.0725	0.0000	302.5565
2022	0.2209	2.0197	2.1226	3.4900e-003	0.0000	0.1047	0.1047	0.0000	0.0986	0.0986	0.0000	299.9943	299.9943	0.0718	0.0000	301.5013
2023	0.2036	1.8606	2.1072	3.4900e-003	0.0000	0.0906	0.0906	0.0000	0.0852	0.0852	0.0000	300.0976	300.0976	0.0713	0.0000	301.5946
2024	0.1920	1.7524	2.1135	3.5200e-003	0.0000	0.0800	0.0800	0.0000	0.0752	0.0752	0.0000	302.4642	302.4642	0.0714	0.0000	303.9639
Total	**2.1783**	**19.8018**	**17.7107**	**0.0284**	**5.8433**	**1.1291**	**6.9724**	**0.5824**	**1.0600**	**1.6424**	**0.0000**	**2,476.4153**	**2,476.4153**	**0.6071**	**0.0000**	**2,489.1644**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-22.48**	**0.00**	**-18.18**	**-22.57**	**0.00**	**-6.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6919	0.1681	1,451.3676
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6438**	**0.2703**	**50,832.7470**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Energy	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	7,880.7783	7,880.7783	0.3138	0.0909	7,915.5473
Mobile	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Waste						0.0000	0.0000		0.0000	0.0000	385.8858	0.0000	385.8858	22.8052	0.0000	864.7950
Water						0.0000	0.0000		0.0000	0.0000	64.6196	1,194.1152	1,258.7348	6.6907	0.1678	1,451.2645
Total	**33.9677**	**37.9133**	**183.9819**	**0.6187**	**38.8288**	**2.5262**	**41.3550**	**10.4037**	**2.4636**	**12.8673**	**617.6942**	**49,466.7340**	**50,084.4281**	**31.6426**	**0.2701**	**50,832.6439**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	4.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0635	0.7129	0.4530	7.5000e-004		0.0377	0.0377		0.0347	0.0347	0.0000	71.1240	71.1240	0.0215	0.0000	71.5745
Total	**0.0635**	**0.7129**	**0.4530**	**7.5000e-004**		**0.0377**	**0.0377**		**0.0347**	**0.0347**	**0.0000**	**71.1240**	**71.1240**	**0.0215**	**0.0000**	**71.5745**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.4000e-004	1.2600e-003	0.0131	3.0000e-005	1.9878	2.0000e-005	1.9878	0.1980	2.0000e-005	0.1980	0.0000	2.1492	2.1492	1.2000e-004	0.0000	2.1517
Total	**7.4000e-004**	**1.2600e-003**	**0.0131**	**3.0000e-005**	**1.9878**	**2.0000e-005**	**1.9878**	**0.1980**	**2.0000e-005**	**0.1980**	**0.0000**	**2.1492**	**2.1492**	**1.2000e-004**	**0.0000**	**2.1517**

3.2 Utility Installation - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0635	0.7129	0.4530	7.5000e-004		0.0377	0.0377		0.0347	0.0347	0.0000	71.1239	71.1239	0.0215	0.0000	71.5745
Total	**0.0635**	**0.7129**	**0.4530**	**7.5000e-004**		**0.0377**	**0.0377**		**0.0347**	**0.0347**	**0.0000**	**71.1239**	**71.1239**	**0.0215**	**0.0000**	**71.5745**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.4000e-004	1.2600e-003	0.0131	3.0000e-005	2.4347	2.0000e-005	2.4347	0.2427	2.0000e-005	0.2427	0.0000	2.1492	2.1492	1.2000e-004	0.0000	2.1517
Total	**7.4000e-004**	**1.2600e-003**	**0.0131**	**3.0000e-005**	**2.4347**	**2.0000e-005**	**2.4347**	**0.2427**	**2.0000e-005**	**0.2427**	**0.0000**	**2.1492**	**2.1492**	**1.2000e-004**	**0.0000**	**2.1517**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0822	0.9120	0.6248	1.0600e-003		0.0476	0.0476		0.0438	0.0438	0.0000	97.9878	97.9878	0.0300	0.0000	98.6183
Total	**0.0822**	**0.9120**	**0.6248**	**1.0600e-003**		**0.0476**	**0.0476**		**0.0438**	**0.0438**	**0.0000**	**97.9878**	**97.9878**	**0.0300**	**0.0000**	**98.6183**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.6000e-003	0.0165	4.0000e-005	2.7829	3.0000e-005	2.7830	0.2772	3.0000e-005	0.2772	0.0000	2.8961	2.8961	1.6000e-004	0.0000	2.8994
Total	**9.3000e-004**	**1.6000e-003**	**0.0165**	**4.0000e-005**	**2.7829**	**3.0000e-005**	**2.7830**	**0.2772**	**3.0000e-005**	**0.2772**	**0.0000**	**2.8961**	**2.8961**	**1.6000e-004**	**0.0000**	**2.8994**

3.2 Utility Installation - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0821	0.9120	0.6248	1.0600e-003		0.0476	0.0476		0.0438	0.0438	0.0000	97.9877	97.9877	0.0300	0.0000	98.6182
Total	**0.0821**	**0.9120**	**0.6248**	**1.0600e-003**		**0.0476**	**0.0476**		**0.0438**	**0.0438**	**0.0000**	**97.9877**	**97.9877**	**0.0300**	**0.0000**	**98.6182**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.6000e-003	0.0165	4.0000e-005	3.4086	3.0000e-005	3.4086	0.3398	3.0000e-005	0.3398	0.0000	2.8961	2.8961	1.6000e-004	0.0000	2.8994
Total	**9.3000e-004**	**1.6000e-003**	**0.0165**	**4.0000e-005**	**3.4086**	**3.0000e-005**	**3.4086**	**0.3398**	**3.0000e-005**	**0.3398**	**0.0000**	**2.8961**	**2.8961**	**1.6000e-004**	**0.0000**	**2.8994**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2358	2.0068	1.3778	2.0400e-003		0.1354	0.1354		0.1272	0.1272	0.0000	182.0041	182.0041	0.0448	0.0000	182.9448
Total	**0.2358**	**2.0068**	**1.3778**	**2.0400e-003**		**0.1354**	**0.1354**		**0.1272**	**0.1272**	**0.0000**	**182.0041**	**182.0041**	**0.0448**	**0.0000**	**182.9448**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2358	2.0068	1.3778	2.0400e-003		0.1354	0.1354		0.1272	0.1272	0.0000	182.0039	182.0039	0.0448	0.0000	182.9446
Total	**0.2358**	**2.0068**	**1.3778**	**2.0400e-003**		**0.1354**	**0.1354**		**0.1272**	**0.1272**	**0.0000**	**182.0039**	**182.0039**	**0.0448**	**0.0000**	**182.9446**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9844	308.9844	0.0756	0.0000	310.5723
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9844**	**308.9844**	**0.0756**	**0.0000**	**310.5723**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3483	3.0355	2.2880	3.5000e-003		0.1950	0.1950		0.1833	0.1833	0.0000	308.9841	308.9841	0.0756	0.0000	310.5720
Total	**0.3483**	**3.0355**	**2.2880**	**3.5000e-003**		**0.1950**	**0.1950**		**0.1833**	**0.1833**	**0.0000**	**308.9841**	**308.9841**	**0.0756**	**0.0000**	**310.5720**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5302	305.5302	0.0743	0.0000	307.0913
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5302**	**305.5302**	**0.0743**	**0.0000**	**307.0913**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.7359	2.2342	3.5000e-003		0.1677	0.1677		0.1577	0.1577	0.0000	305.5299	305.5299	0.0743	0.0000	307.0909
Total	**0.3069**	**2.7359**	**2.2342**	**3.5000e-003**		**0.1677**	**0.1677**		**0.1577**	**0.1577**	**0.0000**	**305.5299**	**305.5299**	**0.0743**	**0.0000**	**307.0909**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1514	302.1514	0.0736	0.0000	303.6973
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1514**	**302.1514**	**0.0736**	**0.0000**	**303.6973**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2020

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2766	2.5000	2.2019	3.5100e-003		0.1458	0.1458		0.1371	0.1371	0.0000	302.1510	302.1510	0.0736	0.0000	303.6969
Total	**0.2766**	**2.5000**	**2.2019**	**3.5100e-003**		**0.1458**	**0.1458**		**0.1371**	**0.1371**	**0.0000**	**302.1510**	**302.1510**	**0.0736**	**0.0000**	**303.6969**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0339	301.0339	0.0725	0.0000	302.5568
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0339**	**301.0339**	**0.0725**	**0.0000**	**302.5568**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2021

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2471	2.2629	2.1582	3.5000e-003		0.1246	0.1246		0.1172	0.1172	0.0000	301.0335	301.0335	0.0725	0.0000	302.5565
Total	**0.2471**	**2.2629**	**2.1582**	**3.5000e-003**		**0.1246**	**0.1246**		**0.1172**	**0.1172**	**0.0000**	**301.0335**	**301.0335**	**0.0725**	**0.0000**	**302.5565**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9946	299.9946	0.0718	0.0000	301.5017
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9946**	**299.9946**	**0.0718**	**0.0000**	**301.5017**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2022

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2209	2.0197	2.1226	3.4900e-003		0.1047	0.1047		0.0986	0.0986	0.0000	299.9943	299.9943	0.0718	0.0000	301.5013
Total	**0.2209**	**2.0197**	**2.1226**	**3.4900e-003**		**0.1047**	**0.1047**		**0.0986**	**0.0986**	**0.0000**	**299.9943**	**299.9943**	**0.0718**	**0.0000**	**301.5013**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2036	1.8606	2.1072	3.4900e-003		0.0906	0.0906		0.0852	0.0852	0.0000	300.0980	300.0980	0.0713	0.0000	301.5949
Total	**0.2036**	**1.8606**	**2.1072**	**3.4900e-003**		**0.0906**	**0.0906**		**0.0852**	**0.0852**	**0.0000**	**300.0980**	**300.0980**	**0.0713**	**0.0000**	**301.5949**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2023

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2036	1.8606	2.1072	3.4900e-003		0.0906	0.0906		0.0852	0.0852	0.0000	300.0976	300.0976	0.0713	0.0000	301.5946
Total	**0.2036**	**1.8606**	**2.1072**	**3.4900e-003**		**0.0906**	**0.0906**		**0.0852**	**0.0852**	**0.0000**	**300.0976**	**300.0976**	**0.0713**	**0.0000**	**301.5946**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1920	1.7524	2.1135	3.5200e-003		0.0800	0.0800		0.0752	0.0752	0.0000	302.4646	302.4646	0.0714	0.0000	303.9643
Total	**0.1920**	**1.7524**	**2.1135**	**3.5200e-003**		**0.0800**	**0.0800**		**0.0752**	**0.0752**	**0.0000**	**302.4646**	**302.4646**	**0.0714**	**0.0000**	**303.9643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Building Construction - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1920	1.7524	2.1135	3.5200e-003		0.0800	0.0800		0.0752	0.0752	0.0000	302.4642	302.4642	0.0714	0.0000	303.9639
Total	**0.1920**	**1.7524**	**2.1135**	**3.5200e-003**		**0.0800**	**0.0800**		**0.0752**	**0.0752**	**0.0000**	**302.4642**	**302.4642**	**0.0714**	**0.0000**	**303.9639**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441
Unmitigated	13.2229	36.0164	157.0312	0.5921	38.8288	0.8069	39.6357	10.4037	0.7446	11.1483	0.0000	40,043.9633	40,043.9633	1.3086	0.0000	40,071.4441

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,072.8188	6,072.8188	0.2792	0.0578	6,096.5848
NaturalGas Mitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625
NaturalGas Unmitigated	0.1827	1.5787	0.7934	9.9600e-003		0.1262	0.1262		0.1262	0.1262	0.0000	1,807.9595	1,807.9595	0.0347	0.0332	1,818.9625

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Condo/Townhouse	1.00842e+007	0.0544	0.4647	0.1977	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	538.1324	538.1324	0.0103	9.8700e-003	541.4074
Condo/Townhouse High Rise	7.70723e+006	0.0416	0.3551	0.1511	2.2700e-003		0.0287	0.0287		0.0287	0.0287	0.0000	411.2869	411.2869	7.8800e-003	7.5400e-003	413.7900
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	4.75455e+006	0.0256	0.2331	0.1958	1.4000e-003		0.0177	0.0177		0.0177	0.0177	0.0000	253.7209	253.7209	4.8600e-003	4.6500e-003	255.2650
Health Club	47025	2.5000e-004	2.3100e-003	1.9400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.5094	2.5094	5.0000e-005	5.0000e-005	2.5247
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	476000	2.5700e-003	0.0233	0.0196	1.4000e-004		1.7700e-003	1.7700e-003		1.7700e-003	1.7700e-003	0.0000	25.4012	25.4012	4.9000e-004	4.7000e-004	25.5558
Single Family Housing	1.01025e+007	0.0545	0.4655	0.1981	2.9700e-003		0.0376	0.0376		0.0376	0.0376	0.0000	539.1089	539.1089	0.0103	9.8800e-003	542.3898
Strip Mall	25500	1.4000e-004	1.2500e-003	1.0500e-003	1.0000e-005		9.0000e-005	9.0000e-005		9.0000e-005	9.0000e-005	0.0000	1.3608	1.3608	3.0000e-005	2.0000e-005	1.3691
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1827**	**1.5788**	**0.7934**	**9.9700e-003**		**0.1262**	**0.1262**		**0.1262**	**0.1262**	**0.0000**	**1,807.9595**	**1,807.9595**	**0.0347**	**0.0332**	**1,818.9625**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.07852e+006	880.9694	0.0405	8.3800e-003	884.4170
Condo/Townhouse High Rise	2.35287e+006	673.3123	0.0310	6.4000e-003	675.9473
Elementary School	420114	120.2226	5.5300e-003	1.1400e-003	120.6931
General Office Building	6.32055e+006	1,808.7321	0.0831	0.0172	1,815.8107
Health Club	30125	8.6208	4.0000e-004	8.0000e-005	8.6545
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	4.2476e+006	1,215.5225	0.0559	0.0116	1,220.2795
Single Family Housing	2.47292e+006	707.6679	0.0325	6.7300e-003	710.4374
Strip Mall	227550	65.1173	2.9900e-003	6.2000e-004	65.3721
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,072.8188**	**0.2792**	**0.0578**	**6,096.5848**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929
Unmitigated	20.5620	0.3181	26.1573	0.0166		1.5930	1.5930		1.5928	1.5928	167.1888	347.8772	515.0660	0.5243	0.0114	529.5929

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7198					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.1949					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	5.1556	0.1308	9.8895	0.0157		1.5029	1.5029		1.5027	1.5027	167.1888	321.2795	488.4683	0.4986	0.0114	502.4564
Landscaping	0.4918	0.1873	16.2678	8.6000e-004		0.0901	0.0901		0.0901	0.0901	0.0000	26.5977	26.5977	0.0257	0.0000	27.1365
Total	**20.5620**	**0.3181**	**26.1573**	**0.0166**		**1.5930**	**1.5930**		**1.5928**	**1.5928**	**167.1888**	**347.8772**	**515.0660**	**0.5243**	**0.0114**	**529.5929**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1,258.7348	6.6907	0.1678	1,451.2645
Unmitigated	1,258.7348	6.6919	0.1681	1,451.3676

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4982	0.0376	318.9359
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1450	0.0287	243.7582
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9785
General Office Building	77.3142 / 47.3861	463.2700	2.5395	0.0637	536.3326
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0257
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6812	0.0171	143.8766
Single Family Housing	22.0872 / 13.9245	133.5787	0.7255	0.0182	154.4561
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7077
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6919**	**0.1681**	**1,451.3676**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 6.6723	21.2133	9.8000e-004	2.0000e-004	21.2963
Condo/Townhouse	45.6078 / 28.7528	275.8262	1.4979	0.0375	318.9128
Condo/Townhouse High Rise	34.8574 / 21.9753	210.8100	1.1448	0.0287	243.7405
Elementary School	1.81818 / 4.67532	22.2160	0.0602	1.6000e-003	23.9776
General Office Building	77.3142 / 47.3861	463.2700	2.5390	0.0636	536.2935
Health Club	0.147858 / 0.0906226	0.8860	4.8600e-003	1.2000e-004	1.0256
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	20.7403 / 12.7118	124.2768	0.6811	0.0171	143.8661
Single Family Housing	22.0872 / 13.9245	133.5787	0.7254	0.0182	154.4449
Strip Mall	1.11109 / 0.680989	6.6577	0.0365	9.1000e-004	7.7071
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,258.7348**	**6.6907**	**0.1678**	**1,451.2645**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	385.8858	22.8052	0.0000	864.7950
Unmitigated	385.8858	22.8052	0.0000	864.7950

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	0.48	0.0974	5.7600e-003	0.0000	0.2184
Condo/Townhouse	322	65.3631	3.8629	0.0000	146.4829
Condo/Townhouse High Rise	246.1	49.9561	2.9523	0.0000	111.9548
Elementary School	136.88	27.7854	1.6421	0.0000	62.2689
General Office Building	404.55	82.1200	4.8532	0.0000	184.0362
Health Club	14.25	2.8926	0.1710	0.0000	6.4826
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	294	59.6793	3.5270	0.0000	133.7453
Single Family Housing	466.99	94.7948	5.6022	0.0000	212.4411
Strip Mall	15.75	3.1971	0.1889	0.0000	7.1649
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**385.8858**	**22.8052**	**0.0000**	**864.7950**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Const Emissions - Utility Inst & Bldg Const - Onsite Truck

Los Angeles-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Client Provided - All Construction Phases (utility installation dates shifted)

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as worker trips is assumed to operate on 100% unpaved area with a speed of 10 mph.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstructionPhase	NumDays	4,650.00	1,979.00

tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	13.00	4.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7125	19.0401	12.4451	0.0209	58.2764	1.0066	59.2830	5.8043	0.9261	6.7304	0.0000	2,156.5708	2,156.5708	0.6342	0.0000	2,169.8886
2017	3.1024	26.4057	18.1291	0.0268	58.2764	1.7812	59.1831	5.8043	1.6730	6.6384	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9390	2,609.9390	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.5701**	**169.3222**	**147.2434**	**0.2354**	**116.5528**	**9.7479**	**125.4261**	**11.6086**	**9.1446**	**19.9143**	**0.0000**	**22,705.8298**	**22,705.8298**	**5.5964**	**0.0000**	**22,823.3541**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7125	19.0401	12.4451	0.0209	71.3784	1.0066	72.3850	7.1145	0.9261	8.0406	0.0000	2,156.5708	2,156.5708	0.6342	0.0000	2,169.8886
2017	3.1024	26.4057	18.1291	0.0268	71.3784	1.7812	72.2850	7.1145	1.6730	7.9486	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.5701**	**169.3222**	**147.2434**	**0.2354**	**142.7568**	**9.7479**	**151.6301**	**14.2290**	**9.1446**	**22.5347**	**0.0000**	**22,705.8298**	**22,705.8298**	**5.5964**	**0.0000**	**22,823.3540**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-22.48**	**0.00**	**-20.89**	**-22.57**	**0.00**	**-13.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Total	**584.5193**	**233.7937**	**1,922.0956**	**5.2098**	**251.2667**	**126.7729**	**378.0396**	**67.2149**	**126.3578**	**193.5727**	**14,743.5296**	**328,756.4382**	**343,499.9678**	**53.5712**	**1.2009**	**344,997.2382**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	4.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256		2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**		**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0203	0.0295	0.3654	7.8000e-004	58.2764	5.6000e-004	58.2770	5.8043	5.1000e-004	5.8048		65.8825	65.8825	3.5600e-003		65.9572
Total	**0.0203**	**0.0295**	**0.3654**	**7.8000e-004**	**58.2764**	**5.6000e-004**	**58.2770**	**5.8043**	**5.1000e-004**	**5.8048**		**65.8825**	**65.8825**	**3.5600e-003**		**65.9572**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256	0.0000	2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**	**0.0000**	**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0203	0.0295	0.3654	7.8000e-004	71.3784	5.6000e-004	71.3790	7.1145	5.1000e-004	7.1150		65.8825	65.8825	3.5600e-003		65.9572
Total	**0.0203**	**0.0295**	**0.3654**	**7.8000e-004**	**71.3784**	**5.6000e-004**	**71.3790**	**7.1145**	**5.1000e-004**	**7.1150**		**65.8825**	**65.8825**	**3.5600e-003**		**65.9572**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336		2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**		**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0181	0.0267	0.3311	7.8000e-004	58.2764	5.3000e-004	58.2770	5.8043	4.9000e-004	5.8048		63.4167	63.4167	3.2900e-003		63.4857
Total	**0.0181**	**0.0267**	**0.3311**	**7.8000e-004**	**58.2764**	**5.3000e-004**	**58.2770**	**5.8043**	**4.9000e-004**	**5.8048**		**63.4167**	**63.4167**	**3.2900e-003**		**63.4857**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336	0.0000	2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**	**0.0000**	**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0181	0.0267	0.3311	7.8000e-004	71.3784	5.3000e-004	71.3789	7.1145	4.9000e-004	7.1150		63.4167	63.4167	3.2900e-003		63.4857
Total	**0.0181**	**0.0267**	**0.3311**	**7.8000e-004**	**71.3784**	**5.3000e-004**	**71.3789**	**7.1145**	**4.9000e-004**	**7.1150**		**63.4167**	**63.4167**	**3.2900e-003**		**63.4857**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730		2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**		**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**	**0.0000**	**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048		2,609.9390	2,609.9390	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**		**2,609.9390**	**2,609.9390**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**	**0.0000**	**2,609.9389**	**2,609.9389**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979		2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**		**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**	**0.0000**	**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581		2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**		**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**	**0.0000**	**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557		2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**		**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**	**0.0000**	**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744		2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**		**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**	**0.0000**	**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179
Unmitigated	85.4150	213.1799	996.4473	3.8896	251.2667	5.1255	256.3921	67.2149	4.7292	71.9441		289,269.6991	289,269.6991	9.1676		289,462.2179

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South - Const Emissions - Utility Inst & Bldg Const - Onsite Truck

Los Angeles-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	0.00	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2024
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Only construction, no need to factor in RPS

Land Use - Client

Construction Phase - Client Provided - All Construction Phases (utility installation dates shifted)

Off-road Equipment -

Off-road Equipment - Client Provided - Equipment type, unit, hrs/day and HP (when equipment fractions were give, 1 unit * number of total hrs was input)
CalEEMod Default - Load Factors, HP for 6 off-highway trucks

Off-road Equipment - Client provided, except HP for off-highway trucks (CalEEMod defaults). Other material handling equipment represent water trucks.

Trips and VMT - Onsite trucks modeled as worker trips

On-road Fugitive Dust - Offroad equipment modeled as worker trips is assumed to operate on 100% unpaved area with a speed of 10 mph.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Area Coating -

Energy Use -

Water And Wastewater -

Solid Waste -

Construction Off-road Equipment Mitigation - Based on 4.7 AQ Mitigation Measures

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2294405	2684105
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstructionPhase	NumDays	4,650.00	1,979.00

tblConstructionPhase	PhaseEndDate	12/26/2024	12/31/2024
tblConstructionPhase	PhaseStartDate	5/27/2017	6/1/2017
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	528,818.40	0.00
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblOffRoadEquipment	HorsePower	162.00	157.00
tblOffRoadEquipment	HorsePower	167.00	196.00
tblOffRoadEquipment	HorsePower	97.00	75.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	MeanVehicleSpeed	40.00	10.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblOnRoadDust	WorkerPercentPave	100.00	0.00
tblProjectCharacteristics	OperationalYear	2014	2024
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	VendorTripNumber	419.00	0.00
tblTripsAndVMT	WorkerTripNumber	13.00	4.00
tblTripsAndVMT	WorkerTripNumber	1,581.00	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7132	19.0433	12.4199	0.0209	58.2764	1.0066	59.2830	5.8043	0.9261	6.7304	0.0000	2,152.8602	2,152.8602	0.6342	0.0000	2,166.1780
2017	3.1024	26.4057	18.1291	0.0268	58.2764	1.7812	59.1831	5.8043	1.6730	6.6384	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9390	2,609.9390	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.5708**	**169.3255**	**147.2181**	**0.2354**	**116.5528**	**9.7479**	**125.4261**	**11.6086**	**9.1446**	**19.9143**	**0.0000**	**22,702.1192**	**22,702.1192**	**5.5964**	**0.0000**	**22,819.6435**

2.1 Overall Construction (Maximum Daily Emission)

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2016	1.7132	19.0433	12.4199	0.0209	71.3784	1.0066	72.3850	7.1145	0.9261	8.0406	0.0000	2,152.8602	2,152.8602	0.6342	0.0000	2,166.1780
2017	3.1024	26.4057	18.1291	0.0268	71.3784	1.7812	72.2850	7.1145	1.6730	7.9486	0.0000	2,639.8053	2,639.8053	0.6497	0.0000	2,653.4490
2018	2.6687	23.2608	17.5327	0.0268	0.0000	1.4943	1.4943	0.0000	1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387	0.0000	2,623.3517
2019	2.3516	20.9650	17.1204	0.0268	0.0000	1.2850	1.2850	0.0000	1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279	0.0000	2,593.9479
2020	2.1113	19.0839	16.8084	0.0268	0.0000	1.1128	1.1128	0.0000	1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194	0.0000	2,555.4880
2021	1.8931	17.3403	16.5376	0.0268	0.0000	0.9549	0.9549	0.0000	0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126	0.0000	2,555.6462
2022	1.6992	15.5364	16.3276	0.0268	0.0000	0.8057	0.8057	0.0000	0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085	0.0000	2,556.5286
2023	1.5661	14.3126	16.2093	0.0268	0.0000	0.6967	0.6967	0.0000	0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044	0.0000	2,557.3191
2024	1.4653	13.3774	16.1332	0.0268	0.0000	0.6106	0.6106	0.0000	0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009	0.0000	2,557.7349
Total	**18.5708**	**169.3255**	**147.2181**	**0.2354**	**142.7568**	**9.7479**	**151.6301**	**14.2290**	**9.1446**	**22.5347**	**0.0000**	**22,702.1192**	**22,702.1192**	**5.5964**	**0.0000**	**22,819.6435**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**-22.48**	**0.00**	**-20.89**	**-22.57**	**0.00**	**-13.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Energy	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
Mobile	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Total	**588.1308**	**245.3138**	**1,923.1355**	**5.0350**	**251.2667**	**126.7866**	**378.0532**	**67.2149**	**126.3703**	**193.5853**	**14,743.5296**	**316,668.2746**	**331,411.8041**	**53.5837**	**1.2009**	**332,909.3385**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Utility Installation	Trenching	9/19/2016	5/26/2017	5	180	
2	Building Construction	Building Construction	6/1/2017	12/31/2024	5	1979	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Utility Installation	Excavators	2	8.00	157	0.38
Utility Installation	Other Material Handling Equipment	1	6.00	196	0.40
Utility Installation	Tractors/Loaders/Backhoes	2	8.00	75	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Utility Installation	5	4.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Soil Stabilizer

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Utility Installation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256		2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**		**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0209	0.0328	0.3402	7.3000e-004	58.2764	5.6000e-004	58.2770	5.8043	5.1000e-004	5.8048		62.1720	62.1720	3.5600e-003		62.2466
Total	**0.0209**	**0.0328**	**0.3402**	**7.3000e-004**	**58.2764**	**5.6000e-004**	**58.2770**	**5.8043**	**5.1000e-004**	**5.8048**		**62.1720**	**62.1720**	**3.5600e-003**		**62.2466**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6923	19.0106	12.0797	0.0201		1.0061	1.0061		0.9256	0.9256	0.0000	2,090.6883	2,090.6883	0.6306		2,103.9314
Total	**1.6923**	**19.0106**	**12.0797**	**0.0201**		**1.0061**	**1.0061**		**0.9256**	**0.9256**	**0.0000**	**2,090.6883**	**2,090.6883**	**0.6306**		**2,103.9314**

3.2 Utility Installation - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0209	0.0328	0.3402	7.3000e-004	71.3784	5.6000e-004	71.3790	7.1145	5.1000e-004	7.1150		62.1720	62.1720	3.5600e-003		62.2466
Total	**0.0209**	**0.0328**	**0.3402**	**7.3000e-004**	**71.3784**	**5.6000e-004**	**71.3790**	**7.1145**	**5.1000e-004**	**7.1150**		**62.1720**	**62.1720**	**3.5600e-003**		**62.2466**

3.2 Utility Installation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336		2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**		**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0186	0.0296	0.3069	7.3000e-004	58.2764	5.3000e-004	58.2770	5.8043	4.9000e-004	5.8048		59.8405	59.8405	3.2900e-003		59.9095
Total	**0.0186**	**0.0296**	**0.3069**	**7.3000e-004**	**58.2764**	**5.3000e-004**	**58.2770**	**5.8043**	**4.9000e-004**	**5.8048**		**59.8405**	**59.8405**	**3.2900e-003**		**59.9095**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5647	17.3716	11.9013	0.0201		0.9061	0.9061		0.8336	0.8336	0.0000	2,057.3912	2,057.3912	0.6304		2,070.6292
Total	**1.5647**	**17.3716**	**11.9013**	**0.0201**		**0.9061**	**0.9061**		**0.8336**	**0.8336**	**0.0000**	**2,057.3912**	**2,057.3912**	**0.6304**		**2,070.6292**

3.2 Utility Installation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0186	0.0296	0.3069	7.3000e-004	71.3784	5.3000e-004	71.3789	7.1145	4.9000e-004	7.1150		59.8405	59.8405	3.2900e-003		59.9095
Total	**0.0186**	**0.0296**	**0.3069**	**7.3000e-004**	**71.3784**	**5.3000e-004**	**71.3789**	**7.1145**	**4.9000e-004**	**7.1150**		**59.8405**	**59.8405**	**3.2900e-003**		**59.9095**

3.3 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730		2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**		**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.1024	26.4057	18.1291	0.0268		1.7812	1.7812		1.6730	1.6730	0.0000	2,639.8053	2,639.8053	0.6497		2,653.4490
Total	**3.1024**	**26.4057**	**18.1291**	**0.0268**		**1.7812**	**1.7812**		**1.6730**	**1.6730**	**0.0000**	**2,639.8053**	**2,639.8053**	**0.6497**		**2,653.4490**

3.3 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048		2,609.9390	2,609.9390	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**		**2,609.9390**	**2,609.9390**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6687	23.2608	17.5327	0.0268		1.4943	1.4943		1.4048	1.4048	0.0000	2,609.9389	2,609.9389	0.6387		2,623.3517
Total	**2.6687**	**23.2608**	**17.5327**	**0.0268**		**1.4943**	**1.4943**		**1.4048**	**1.4048**	**0.0000**	**2,609.9389**	**2,609.9389**	**0.6387**		**2,623.3517**

3.3 Building Construction - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083	0.0000	2,580.7618	2,580.7618	0.6279		2,593.9479
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,593.9479**

3.3 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465	0.0000	2,542.4799	2,542.4799	0.6194		2,555.4880
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,555.4880**

3.3 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979		2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**		**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8931	17.3403	16.5376	0.0268		0.9549	0.9549		0.8979	0.8979	0.0000	2,542.7817	2,542.7817	0.6126		2,555.6462
Total	**1.8931**	**17.3403**	**16.5376**	**0.0268**		**0.9549**	**0.9549**		**0.8979**	**0.8979**	**0.0000**	**2,542.7817**	**2,542.7817**	**0.6126**		**2,555.6462**

3.3 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581		2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**		**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.6992	15.5364	16.3276	0.0268		0.8057	0.8057		0.7581	0.7581	0.0000	2,543.7497	2,543.7497	0.6085		2,556.5286
Total	**1.6992**	**15.5364**	**16.3276**	**0.0268**		**0.8057**	**0.8057**		**0.7581**	**0.7581**	**0.0000**	**2,543.7497**	**2,543.7497**	**0.6085**		**2,556.5286**

3.3 Building Construction - 2022

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557		2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**		**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.5661	14.3126	16.2093	0.0268		0.6967	0.6967		0.6557	0.6557	0.0000	2,544.6262	2,544.6262	0.6044		2,557.3191
Total	**1.5661**	**14.3126**	**16.2093**	**0.0268**		**0.6967**	**0.6967**		**0.6557**	**0.6557**	**0.0000**	**2,544.6262**	**2,544.6262**	**0.6044**		**2,557.3191**

3.3 Building Construction - 2023

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.3 Building Construction - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744		2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**		**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4653	13.3774	16.1332	0.0268		0.6106	0.6106		0.5744	0.5744	0.0000	2,545.1154	2,545.1154	0.6009		2,557.7349
Total	**1.4653**	**13.3774**	**16.1332**	**0.0268**		**0.6106**	**0.6106**		**0.5744**	**0.5744**	**0.0000**	**2,545.1154**	**2,545.1154**	**0.6009**		**2,557.7349**

3.3 Building Construction - 2024

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182
Unmitigated	89.0265	224.6999	997.4872	3.7148	251.2667	5.1391	256.4058	67.2149	4.7418	71.9567		277,181.5355	277,181.5355	9.1801		277,374.3182

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	8.90	8.90	8.90	29,485	29,485
Condo/Townhouse	4,613.00	5,012.00	4249.00	22,442,689	22,442,689
Condo/Townhouse High Rise	3,525.65	3,830.60	3247.45	17,152,626	17,152,626
Elementary School	967.50	0.00	0.00	2,694,383	2,694,383
General Office Building	4,789.35	1,030.95	426.30	13,454,658	13,454,658
Health Club	82.33	52.18	66.83	189,401	189,401
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,023.20	13,991.60	7067.20	29,318,118	29,318,118
Single Family Housing	3,244.23	3,417.12	2973.03	15,698,149	15,698,149
Strip Mall	664.80	630.60	306.45	1,353,161	1,353,161
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	29,918.96	27,973.95	18,345.16	102,332,671	102,332,671

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	18.50	10.10	7.90	33.00	48.00	19.00	66	28	6
Condo/Townhouse	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Condo/Townhouse High Rise	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Elementary School	18.50	10.10	7.90	65.00	30.00	5.00	63	25	12
General Office Building	18.50	10.10	7.90	33.00	48.00	19.00	77	19	4
Health Club	18.50	10.10	7.90	16.90	64.10	19.00	52	39	9
Parking Lot	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0
Regional Shopping Center	18.50	10.10	7.90	16.30	64.70	19.00	54	35	11
Single Family Housing	19.80	9.60	12.90	40.20	19.20	40.60	86	11	3
Strip Mall	18.50	10.10	7.90	16.60	64.40	19.00	45	40	15
Unenclosed Parking with	18.50	10.10	7.90	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.520397	0.057988	0.180404	0.127035	0.040743	0.006604	0.017532	0.037311	0.002617	0.003209	0.003763	0.000522	0.001873

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461
NaturalGas Unmitigated	1.0010	8.6506	4.3475	0.0546		0.6916	0.6916		0.6916	0.6916		10,920.1876	10,920.1876	0.2093	0.2002	10,986.6461

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21115.7	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1870.8	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13026.2	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	128.836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1304.11	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27678.1	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	69.863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Condo/Townhouse	27.628	0.2980	2.5461	1.0835	0.0163		0.2059	0.2059		0.2059	0.2059		3,250.3533	3,250.3533	0.0623	0.0596	3,270.1344
Condo/Townhouse High Rise	21.1157	0.2277	1.9460	0.8281	0.0124		0.1573	0.1573		0.1573	0.1573		2,484.1986	2,484.1986	0.0476	0.0455	2,499.3170
Elementary School	1.8708	0.0202	0.1834	0.1541	1.1000e-003		0.0139	0.0139		0.0139	0.0139		220.0939	220.0939	4.2200e-003	4.0400e-003	221.4334
General Office Building	13.0262	0.1405	1.2771	1.0727	7.6600e-003		0.0971	0.0971		0.0971	0.0971		1,532.4899	1,532.4899	0.0294	0.0281	1,541.8164
Health Club	0.128836	1.3900e-003	0.0126	0.0106	8.0000e-005		9.6000e-004	9.6000e-004		9.6000e-004	9.6000e-004		15.1571	15.1571	2.9000e-004	2.8000e-004	15.2494
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30411	0.0141	0.1279	0.1074	7.7000e-004		9.7200e-003	9.7200e-003		9.7200e-003	9.7200e-003		153.4247	153.4247	2.9400e-003	2.8100e-003	154.3584
Single Family Housing	27.6781	0.2985	2.5507	1.0854	0.0163		0.2062	0.2062		0.2062	0.2062		3,256.2510	3,256.2510	0.0624	0.0597	3,276.0680
Strip Mall	0.069863	7.5000e-004	6.8500e-003	5.7500e-003	4.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004		8.2192	8.2192	1.6000e-004	1.5000e-004	8.2692
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**1.0010**	**8.6506**	**4.3475**	**0.0546**		**0.6916**	**0.6916**		**0.6916**	**0.6916**		**10,920.1877**	**10,920.1877**	**0.2093**	**0.2002**	**10,986.6461**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742
Unmitigated	498.1032	11.9632	921.3007	1.2656		120.9559	120.9559		120.9370	120.9370	14,743.5296	28,566.5515	43,310.0810	44.1943	1.0007	44,548.3742

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	14.9032					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	66.8211					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	412.4447	10.4646	791.1583	1.2587		120.2352	120.2352		120.2163	120.2163	14,743.5296	28,332.0000	43,075.5296	43.9681	1.0007	44,309.0714
Landscaping	3.9343	1.4986	130.1425	6.8800e-003		0.7207	0.7207		0.7207	0.7207		234.5515	234.5515	0.2263		239.3028
Total	**498.1032**	**11.9632**	**921.3007**	**1.2656**		**120.9559**	**120.9559**		**120.9370**	**120.9370**	**14,743.5296**	**28,566.5515**	**43,310.0810**	**44.1943**	**1.0007**	**44,548.3743**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Entrada South (Operational) - Scenario 2 - 2020 Actual

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	528,818.40	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2020
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	501.88	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - 33% RPS by Year 2020

Land Use - Based on Project Description and Client Data.

Construction Phase - No Construction information evaluated (Operational Run only)

Trips and VMT -

Grading - Client Provided Data

Vehicle Trips - Based on Stantec Data by Landuse. Applied 8.85% reduction from TDM measures.

Vechicle Emission Factors - CO2 EF accounts for Pavley, LCFS, and ACC.

Vechicle Emission Factors -

Vechicle Emission Factors -

Woodstoves - Based on Client information, no woodstoves and no wood burning fireplaces.

Energy Use - 2013 T24 for electricity and NG. 25% and 30% better for res and non-res as compared to 2008 T24

Water And Wastewater - Total Indoor and Outdoor water use based on Client Data. Distributed between land uses based on default CalEEMod distribution.

Solid Waste - Defaults

Land Use Change - Based on Client Data

Sequestration - Based on client Data

Energy Mitigation - Based on Client data. 2 kW panel per single family home, 2 kW panel per 1600 SF commercial space.

Water Mitigation - Based on Client Data

Operational Off-Road Equipment -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2318202	2318201
tblConstructionPhase	NumDays	300.00	1.00
tblEnergyUse	T24E	269.81	202.36
tblEnergyUse	T24E	269.81	202.36
tblEnergyUse	T24E	5.62	3.93
tblEnergyUse	T24E	2.75	1.93
tblEnergyUse	T24E	4.90	3.43
tblEnergyUse	T24E	596.10	447.08
tblEnergyUse	T24E	4.90	3.43
tblEnergyUse	T24NG	11,455.03	8,591.27
tblEnergyUse	T24NG	11,455.03	8,591.27
tblEnergyUse	T24NG	10.54	7.38

tblEnergyUse	T24NG	14.36	10.05
tblEnergyUse	T24NG	1.21	0.85
tblEnergyUse	T24NG	23,944.02	17,958.02
tblEnergyUse	T24NG	1.21	0.85
tblFireplaces	NumberGas	595.00	560.00
tblFireplaces	NumberGas	454.75	428.00
tblFireplaces	NumberGas	288.15	271.20
tblFireplaces	NumberNoFireplace	70.00	140.00
tblFireplaces	NumberNoFireplace	53.50	107.00
tblFireplaces	NumberNoFireplace	33.90	67.80
tblFireplaces	NumberWood	35.00	0.00
tblFireplaces	NumberWood	26.75	0.00
tblFireplaces	NumberWood	16.95	0.00
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	CO2IntensityFactor	630.89	501.88
tblProjectCharacteristics	OperationalYear	2014	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSequestration	NumberOfNewTrees	0.00	3,911.00

tblSequestration	NumberOfNewTrees	0.00	89.00
tblSolidWaste	SolidWasteGenerationRate	0.48	59.13
tblSolidWaste	SolidWasteGenerationRate	322.00	3,262.22
tblSolidWaste	SolidWasteGenerationRate	246.10	2,492.44
tblSolidWaste	SolidWasteGenerationRate	136.88	230.26
tblSolidWaste	SolidWasteGenerationRate	404.55	4,885.92
tblSolidWaste	SolidWasteGenerationRate	14.25	3.94
tblSolidWaste	SolidWasteGenerationRate	294.00	3,145.72
tblSolidWaste	SolidWasteGenerationRate	466.99	1,579.79
tblSolidWaste	SolidWasteGenerationRate	15.75	169.51
tblVehicleEF	LDA	257.96	247.65
tblVehicleEF	LDA	53.04	51.45
tblVehicleEF	LDT1	318.76	315.02
tblVehicleEF	LDT1	64.29	63.70
tblVehicleEF	LDT2	384.11	378.07
tblVehicleEF	LDT2	77.68	76.70
tblVehicleEF	MDV	510.84	504.24
tblVehicleEF	MDV	103.50	102.54
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	30.00	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	64.10	0.00

tblVehicleTrips	CC_TTP	64.70	0.00
tblVehicleTrips	CC_TTP	64.40	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	5.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	65.00	100.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	16.90	100.00
tblVehicleTrips	CW_TTP	16.30	100.00
tblVehicleTrips	CW_TTP	16.60	100.00

tblVehicleTrips	DV_TP	28.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	25.00	0.00
tblVehicleTrips	DV_TP	19.00	0.00
tblVehicleTrips	DV_TP	39.00	0.00
tblVehicleTrips	DV_TP	35.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	40.00	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	PB_TP	6.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00

tblVehicleTrips	PB_TP	12.00	0.00
tblVehicleTrips	PB_TP	4.00	0.00
tblVehicleTrips	PB_TP	9.00	0.00
tblVehicleTrips	PB_TP	11.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	15.00	0.00
tblVehicleTrips	PR_TP	66.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	63.00	100.00
tblVehicleTrips	PR_TP	77.00	100.00
tblVehicleTrips	PR_TP	52.00	100.00
tblVehicleTrips	PR_TP	54.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	45.00	100.00
tblVehicleTrips	ST_TR	1.59	1.79
tblVehicleTrips	ST_TR	7.16	7.44
tblVehicleTrips	ST_TR	7.16	7.44
tblVehicleTrips	ST_TR	2.37	1.99
tblVehicleTrips	ST_TR	20.87	1.31
tblVehicleTrips	ST_TR	49.97	50.35
tblVehicleTrips	ST_TR	10.08	7.21
tblVehicleTrips	ST_TR	42.04	64.54
tblVehicleTrips	SU_TR	1.59	1.79
tblVehicleTrips	SU_TR	6.07	6.30
tblVehicleTrips	SU_TR	6.07	6.30
tblVehicleTrips	SU_TR	0.98	0.82
tblVehicleTrips	SU_TR	26.73	1.68
tblVehicleTrips	SU_TR	25.24	25.43
tblVehicleTrips	SU_TR	8.77	6.27

tblVehicleTrips	SU_TR	20.43	31.36
tblVehicleTrips	WD_TR	1.59	1.79
tblVehicleTrips	WD_TR	6.59	6.84
tblVehicleTrips	WD_TR	6.59	6.84
tblVehicleTrips	WD_TR	1.29	1.03
tblVehicleTrips	WD_TR	11.01	9.25
tblVehicleTrips	WD_TR	32.93	2.07
tblVehicleTrips	WD_TR	42.94	43.27
tblVehicleTrips	WD_TR	9.57	6.84
tblVehicleTrips	WD_TR	44.32	68.04
tblWater	IndoorWaterUseRate	45,607,817.94	20,129,663.84
tblWater	IndoorWaterUseRate	34,857,403.71	15,384,814.51
tblWater	IndoorWaterUseRate	1,818,180.00	802,479.79
tblWater	IndoorWaterUseRate	77,314,180.38	34,123,721.14
tblWater	IndoorWaterUseRate	147,857.86	64,945,815.15
tblWater	IndoorWaterUseRate	20,740,306.02	9,154,031.19
tblWater	IndoorWaterUseRate	22,087,214.69	9,748,508.63
tblWater	IndoorWaterUseRate	1,111,087.82	490,394.53
tblWater	OutdoorWaterUseRate	6,672,295.56	30,931,089.44
tblWater	OutdoorWaterUseRate	28,752,754.79	41,239,069.15
tblWater	OutdoorWaterUseRate	21,975,319.73	31,518,431.42
tblWater	OutdoorWaterUseRate	4,675,320.00	6,705,647.73
tblWater	OutdoorWaterUseRate	47,386,110.55	67,964,238.70
tblWater	OutdoorWaterUseRate	90,622.56	129,976.76
tblWater	OutdoorWaterUseRate	12,711,800.46	18,232,090.18
tblWater	OutdoorWaterUseRate	13,924,548.39	19,971,492.06
tblWater	OutdoorWaterUseRate	680,989.31	976,719.12
tblWoodstoves	NumberCatalytic	35.00	0.00
tblWoodstoves	NumberCatalytic	26.75	0.00
tblWoodstoves	NumberCatalytic	16.95	0.00

tblWoodstoves	NumberNoncatalytic	35.00	0.00
tblWoodstoves	NumberNoncatalytic	26.75	0.00
tblWoodstoves	NumberNoncatalytic	16.95	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	2.3400e-003	0.0249	0.0189	2.0000e-005	1.1000e-004	1.2600e-003	1.3800e-003	3.0000e-005	1.1800e-003	1.2100e-003	0.0000	2.0034	2.0034	5.2000e-004	0.0000	2.0143
Total	**2.3400e-003**	**0.0249**	**0.0189**	**2.0000e-005**	**1.1000e-004**	**1.2600e-003**	**1.3800e-003**	**3.0000e-005**	**1.1800e-003**	**1.2100e-003**	**0.0000**	**2.0034**	**2.0034**	**5.2000e-004**	**0.0000**	**2.0143**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	2.3400e-003	0.0249	0.0189	2.0000e-005	1.1000e-004	1.2600e-003	1.3800e-003	3.0000e-005	1.1800e-003	1.2100e-003	0.0000	2.0034	2.0034	5.2000e-004	0.0000	2.0143
Total	**2.3400e-003**	**0.0249**	**0.0189**	**2.0000e-005**	**1.1000e-004**	**1.2600e-003**	**1.3800e-003**	**3.0000e-005**	**1.1800e-003**	**1.2100e-003**	**0.0000**	**2.0034**	**2.0034**	**5.2000e-004**	**0.0000**	**2.0143**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.1487	0.1888	16.3306	8.6000e-004		0.1108	0.1108		0.1106	0.1106	0.0000	328.9784	328.9784	0.0319	5.5400e-003	331.3662
Energy	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	6,071.2677	6,071.2677	0.2955	0.0817	6,102.8047
Mobile	15.0482	48.6324	184.4270	0.5729	38.1898	0.7918	38.9816	10.2298	0.7302	10.9600	0.0000	39,609.4283	39,609.4283	1.4930	0.0000	39,640.7819
Waste						0.0000	0.0000		0.0000	0.0000	3,213.1289	0.0000	3,213.1289	189.8905	0.0000	7,200.8290
Water						0.0000	0.0000		0.0000	0.0000	49.1044	1,009.3232	1,058.4276	5.1018	0.1312	1,206.2234
Total	**32.3415**	**50.0703**	**201.3805**	**0.5817**	**38.1898**	**1.0026**	**39.1924**	**10.2298**	**0.9408**	**11.1705**	**3,262.2333**	**47,018.9976**	**50,281.2309**	**196.8127**	**0.2184**	**54,482.0052**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.1487	0.1888	16.3306	8.6000e-004		0.1108	0.1108		0.1106	0.1106	0.0000	328.9784	328.9784	0.0319	5.5400e-003	331.3662
Energy	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	5,637.7317	5,637.7317	0.2705	0.0765	5,667.1359
Mobile	15.0482	48.6324	184.4270	0.5729	38.1898	0.7918	38.9816	10.2298	0.7302	10.9600	0.0000	39,609.4283	39,609.4283	1.4930	0.0000	39,640.7819

Waste						0.0000	0.0000		0.0000	0.0000	803.2822	0.0000	803.2822	47.4726	0.0000	1,800.2073
Water						0.0000	0.0000		0.0000	0.0000	49.1044	970.5349	1,019.6393	5.0987	0.1305	1,167.1660
Total	**32.3415**	**50.0703**	**201.3805**	**0.5817**	**38.1898**	**1.0026**	**39.1924**	**10.2298**	**0.9408**	**11.1705**	**852.3866**	**46,546.6733**	**47,399.0599**	**54.3667**	**0.2126**	**48,606.6573**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**73.87**	**1.00**	**5.73**	**72.38**	**2.67**	**10.78**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	2,836.8060
Vegetation Land Change	-4,114.3010
Total	**-1,277.4950**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/1/2014	5	1	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0248	0.0181	2.0000e-005		1.2600e-003	1.2600e-003		1.1800e-003	1.1800e-003	0.0000	1.8888	1.8888	5.1000e-004	0.0000	1.8995
Total	**2.3000e-003**	**0.0248**	**0.0181**	**2.0000e-005**		**1.2600e-003**	**1.2600e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**1.8888**	**1.8888**	**5.1000e-004**	**0.0000**	**1.8995**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	8.0000e-005	8.0000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1146	0.1146	1.0000e-005	0.0000	0.1147
Total	**5.0000e-005**	**8.0000e-005**	**8.0000e-004**	**0.0000**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1146**	**0.1146**	**1.0000e-005**	**0.0000**	**0.1147**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0248	0.0181	2.0000e-005		1.2600e-003	1.2600e-003		1.1800e-003	1.1800e-003	0.0000	1.8888	1.8888	5.1000e-004	0.0000	1.8995
Total	**2.3000e-003**	**0.0248**	**0.0181**	**2.0000e-005**		**1.2600e-003**	**1.2600e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**1.8888**	**1.8888**	**5.1000e-004**	**0.0000**	**1.8995**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	8.0000e-005	8.0000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1146	0.1146	1.0000e-005	0.0000	0.1147
Total	**5.0000e-005**	**8.0000e-005**	**8.0000e-004**	**0.0000**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1146**	**0.1146**	**1.0000e-005**	**0.0000**	**0.1147**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	15.0482	48.6324	184.4270	0.5729	38.1898	0.7918	38.9816	10.2298	0.7302	10.9600	0.0000	39,609.4283	39,609.4283	1.4930	0.0000	39,640.7819
Mitigated	15.0482	48.6324	184.4270	0.5729	38.1898	0.7918	38.9816	10.2298	0.7302	10.9600	0.0000	39,609.4283	39,609.4283	1.4930	0.0000	39,640.7819

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	10.02	10.02	10.02	36,925	36,925
Condo/Townhouse	4,788.00	5,208.00	4410.00	18,217,967	18,217,967
Condo/Townhouse High Rise	3,659.40	3,980.40	3370.50	13,923,732	13,923,732
Elementary School	772.50	0.00	0.00	2,032,602	2,032,602
General Office Building	4,023.75	865.65	356.70	11,230,540	11,230,540
Health Club	5.18	3.28	4.20	17,550	17,550
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	12,115.60	14,098.00	7120.40	43,044,538	43,044,538
Single Family Housing	2,318.76	2,444.19	2125.53	8,774,852	8,774,852
Strip Mall	1,020.60	968.10	470.40	3,442,399	3,442,399

Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	28,713.81	27,577.64	17,867.75	100,721,105	100,721,105

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse High Rise	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Elementary School	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
General Office Building	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Health Club	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Regional Shopping Center	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Single Family Housing	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Strip Mall	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Unenclosed Parking with	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.530094	0.057664	0.178835	0.124843	0.039181	0.006319	0.017052	0.034445	0.002509	0.003148	0.003693	0.000531	0.001685

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

Kilowatt Hours of Renewable Electricity Generated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

NaturalGas Unmitigated	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	1,431.3406	1,431.3406	0.0274	0.0262	1,440.0515
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	4,206.3911	4,206.3911	0.2431	0.0503	4,227.0844
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	4,639.9271	4,639.9271	0.2681	0.0555	4,662.7532
NaturalGas Mitigated	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	1,431.3406	1,431.3406	0.0274	0.0262	1,440.0515

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	8.07959e+006	0.0436	0.3723	0.1584	2.3800e-003		0.0301	0.0301		0.0301	0.0301	0.0000	431.1576	431.1576	8.2600e-003	7.9000e-003	433.7816
Condo/Townhouse High Rise	6.17511e+006	0.0333	0.2845	0.1211	1.8200e-003		0.0230	0.0230		0.0230	0.0230	0.0000	329.5276	329.5276	6.3200e-003	6.0400e-003	331.5331
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	3.37995e+006	0.0182	0.1657	0.1392	9.9000e-004		0.0126	0.0126		0.0126	0.0126	0.0000	180.3670	180.3670	3.4600e-003	3.3100e-003	181.4647
Health Club	36250	2.0000e-004	1.7800e-003	1.4900e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.4000e-004	1.4000e-004	0.0000	1.9344	1.9344	4.0000e-005	4.0000e-005	1.9462
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	375200	2.0200e-003	0.0184	0.0155	1.1000e-004		1.4000e-003	1.4000e-003		1.4000e-003	1.4000e-003	0.0000	20.0221	20.0221	3.8000e-004	3.7000e-004	20.1440
Single Family Housing	8.07326e+006	0.0435	0.3720	0.1583	2.3700e-003		0.0301	0.0301		0.0301	0.0301	0.0000	430.8202	430.8202	8.2600e-003	7.9000e-003	433.4421
Strip Mall	20100	1.1000e-004	9.9000e-004	8.3000e-004	1.0000e-005		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005	0.0000	1.0726	1.0726	2.0000e-005	2.0000e-005	1.0791
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1446**	**1.2491**	**0.6229**	**7.8900e-003**		**0.0999**	**0.0999**		**0.0999**	**0.0999**	**0.0000**	**1,431.3406**	**1,431.3406**	**0.0274**	**0.0263**	**1,440.0515**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	8.07959e+006	0.0436	0.3723	0.1584	2.3800e-003		0.0301	0.0301		0.0301	0.0301	0.0000	431.1576	431.1576	8.2600e-003	7.9000e-003	433.7816
Condo/Townhouse High Rise	6.17511e+006	0.0333	0.2845	0.1211	1.8200e-003		0.0230	0.0230		0.0230	0.0230	0.0000	329.5276	329.5276	6.3200e-003	6.0400e-003	331.5331
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	3.37995e+006	0.0182	0.1657	0.1392	9.9000e-004		0.0126	0.0126		0.0126	0.0126	0.0000	180.3670	180.3670	3.4600e-003	3.3100e-003	181.4647
Health Club	36250	2.0000e-004	1.7800e-003	1.4900e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.4000e-004	1.4000e-004	0.0000	1.9344	1.9344	4.0000e-005	4.0000e-005	1.9462
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	375200	2.0200e-003	0.0184	0.0155	1.1000e-004		1.4000e-003	1.4000e-003		1.4000e-003	1.4000e-003	0.0000	20.0221	20.0221	3.8000e-004	3.7000e-004	20.1440
Single Family Housing	8.07326e+006	0.0435	0.3720	0.1583	2.3700e-003		0.0301	0.0301		0.0301	0.0301	0.0000	430.8202	430.8202	8.2600e-003	7.9000e-003	433.4421
Strip Mall	20100	1.1000e-004	9.9000e-004	8.3000e-004	1.0000e-005		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005	0.0000	1.0726	1.0726	2.0000e-005	2.0000e-005	1.0791
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1446**	**1.2491**	**0.6229**	**7.8900e-003**		**0.0999**	**0.0999**		**0.0999**	**0.0999**	**0.0000**	**1,431.3406**	**1,431.3406**	**0.0274**	**0.0263**	**1,440.0515**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			

City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.0313e+006	690.0725	0.0399	8.2500e-003	693.4673
Condo/Townhouse High Rise	2.31678e+006	527.4125	0.0305	6.3100e-003	530.0071
Elementary School	420114	95.6384	5.5300e-003	1.1400e-003	96.1089
General Office Building	5.5854e+006	1,271.5104	0.0735	0.0152	1,277.7656
Health Club	28075	6.3912	3.7000e-004	8.0000e-005	6.4227
Parking Lot	465360	105.9388	6.1200e-003	1.2700e-003	106.4599
Regional Shopping Center	3.836e+006	873.2613	0.0505	0.0104	877.5573
Single Family Housing	2.4224e+006	551.4574	0.0319	6.5900e-003	554.1703
Strip Mall	205500	46.7819	2.7000e-003	5.6000e-004	47.0120
Unenclosed Parking with	2.07101e+006	471.4628	0.0272	5.6400e-003	473.7821
Total		**4,639.9271**	**0.2681**	**0.0555**	**4,662.7532**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	-173128	-39.4124	-0.0023	-0.0005	-39.6063
Condo/Townhouse	2.85817e+006	650.6601	0.0376	7.7800e-003	653.8610
Condo/Townhouse High Rise	2.14365e+006	488.0002	0.0282	5.8300e-003	490.4009
Elementary School	246986	56.2261	3.2500e-003	6.7000e-004	56.5027
General Office Building	5.41227e+006	1,232.0980	0.0712	0.0147	1,238.1593

Health Club	-145053	-33.0211	-0.0019	-0.0004	-33.1836
Parking Lot	292232	66.5264	3.8400e-003	8.0000e-004	66.8537
Regional Shopping Center	3.66287e+006	833.8490	0.0482	9.9700e-003	837.9511
Single Family Housing	2.24927e+006	512.0450	0.0296	6.1200e-003	514.5640
Strip Mall	32372.2	7.3695	4.3000e-004	9.0000e-005	7.4058
Unenclosed Parking with Elevator	1.89788e+006	432.0504	0.0250	5.1700e-003	434.1759
Total		**4,206.3911**	**0.2431**	**0.0503**	**4,227.0845**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	17.1487	0.1888	16.3306	8.6000e-004		0.1108	0.1108		0.1106	0.1106	0.0000	328.9784	328.9784	0.0319	5.5400e-003	331.3662
Mitigated	17.1487	0.1888	16.3306	8.6000e-004		0.1108	0.1108		0.1106	0.1106	0.0000	328.9784	328.9784	0.0319	5.5400e-003	331.3662

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					

Architectural Coating	2.5124					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0306	0.0000	1.6700e-003	0.0000		0.0211	0.0211		0.0209	0.0209	0.0000	302.3807	302.3807	5.8000e-003	5.5400e-003	304.2209
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.1487**	**0.1888**	**16.3306**	**8.6000e-004**		**0.1108**	**0.1108**		**0.1106**	**0.1106**	**0.0000**	**328.9784**	**328.9784**	**0.0319**	**5.5400e-003**	**331.3662**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.5124					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0306	0.0000	1.6700e-003	0.0000		0.0211	0.0211		0.0209	0.0209	0.0000	302.3807	302.3807	5.8000e-003	5.5400e-003	304.2209
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.1487**	**0.1888**	**16.3306**	**8.6000e-004**		**0.1108**	**0.1108**		**0.1106**	**0.1106**	**0.0000**	**328.9784**	**328.9784**	**0.0319**	**5.5400e-003**	**331.3662**

7.0 Water Detail

7.1 Mitigation Measures Water

Use Reclaimed Water

	Total CO2	CH4	N2O	CO2e

Category	MT/yr			
Unmitigated	1,058.4276	5.1018	0.1312	1,206.2234
Mitigated	1,019.6393	5.0987	0.1305	1,167.1660

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 30.9311	78.2303	4.5200e-003	9.4000e-004	78.6151
Condo/Townhouse	20.1297 / 41.2391	170.3559	0.6654	0.0175	189.7382
Condo/Townhouse High Rise	15.3848 / 31.5184	130.2006	0.5086	0.0133	145.0142
Elementary School	0.80248 / 6.70565	19.5931	0.0273	8.5000e-004	20.4288
General Office Building	34.1237 / 67.9642	283.8698	1.1277	0.0295	316.7024
Health Club	64.9458 / 0.129977	213.4465	2.1274	0.0523	274.3272
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	9.15403 / 18.2321	76.1509	0.3025	7.9200e-003	84.9586
Single Family Housing	9.74851 / 19.9715	82.5009	0.3222	8.4500e-003	91.8875
Strip Mall	0.490395 / 0.976719	4.0795	0.0162	4.2000e-004	4.5514
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,058.4276**	**5.1018**	**0.1312**	**1,206.2234**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 28.7518	72.7184	4.2000e-003	8.7000e-004	73.0762
Condo/Townhouse	20.1297 / 38.3335	163.0072	0.6649	0.0173	182.3431
Condo/Townhouse High Rise	15.3848 / 29.2977	124.5841	0.5081	0.0133	139.3623
Elementary School	0.80248 / 6.23319	18.3982	0.0272	8.3000e-004	19.2275
General Office Building	34.1237 / 63.1757	271.7586	1.1268	0.0293	304.5144
Health Club	64.9458 / 0.120819	213.4234	2.1270	0.0522	274.2711
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	9.15403 / 16.9475	72.9020	0.3023	7.8700e-003	81.6891
Single Family Housing	9.74851 / 18.5644	78.9421	0.3220	8.4000e-003	88.3062
Strip Mall	0.490395 / 0.907902	3.9055	0.0162	4.2000e-004	4.3762
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,019.6393**	**5.0987**	**0.1305**	**1,167.1660**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	803.2822	47.4726	0.0000	1,800.2073
Unmitigated	3,213.1289	189.8905	0.0000	7,200.8290

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	59.13	12.0029	0.7094	0.0000	26.8992
Condo/Townhouse	3262.22	662.2020	39.1350	0.0000	1,484.0373
Condo/Townhouse High Rise	2492.44	505.9426	29.9004	0.0000	1,133.8500
Elementary School	230.256	46.7399	2.7623	0.0000	104.7471
General Office Building	4885.92	991.7976	58.6136	0.0000	2,222.6824
Health Club	3.942	0.8002	0.0473	0.0000	1.7933
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3145.72	638.5519	37.7373	0.0000	1,431.0360
Single Family Housing	1579.79	320.6837	18.9519	0.0000	718.6728
Strip Mall	169.506	34.4082	2.0335	0.0000	77.1110

Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**3,213.1289**	**189.8905**	**0.0000**	**7,200.8290**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	14.7825	3.0007	0.1773	0.0000	6.7248
Condo/Townhouse	815.556	165.5505	9.7838	0.0000	371.0093
Condo/Townhouse High Rise	623.11	126.4857	7.4751	0.0000	283.4625
Elementary School	57.564	11.6850	0.6906	0.0000	26.1868
General Office Building	1221.48	247.9494	14.6534	0.0000	555.6706
Health Club	0.9855	0.2001	0.0118	0.0000	0.4483
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	786.429	159.6380	9.4343	0.0000	357.7590
Single Family Housing	394.948	80.1709	4.7380	0.0000	179.6682
Strip Mall	42.3765	8.6021	0.5084	0.0000	19.2777
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**803.2822**	**47.4726**	**0.0000**	**1,800.2072**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

	0	0.00	0			Diesel

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	-1,277.4950	0.0000	0.0000	-1,277.4950

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Cropland	7.4 / 0	-45.8800	0.0000	0.0000	-45.8800
Grassland	39.1 / 0	-168.5210	0.0000	0.0000	-168.5210
Others	107.5 / 0	0.0000	0.0000	0.0000	0.0000
Scrub	244 / 0	-3,489.2000	0.0000	0.0000	-3,489.2000
Trees	3.7 / 0	-410.7000	0.0000	0.0000	-410.7000
Wetlands	17.1 / 0	0.0000	0.0000	0.0000	0.0000
Total		**-4,114.3010**	**0.0000**	**0.0000**	**-4,114.3010**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Miscellaneous	3911	2,768.9880	0.0000	0.0000	2,768.9880
True Fir/Hemlock	89	67.8180	0.0000	0.0000	67.8180
Total		**2,836.8060**	**0.0000**	**0.0000**	**2,836.8060**

Entrada South (Operational) - Scenario 2a - 2020 Actual Unmitigated

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	528,818.40	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2020
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	501.88	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - 33% RPS by Year 2020

Land Use - Based on Project Description and Client Data.

Construction Phase - No Construction information evaluated (Operational Run only)

Trips and VMT -

Grading - Client Provided Data

Vehicle Trips - Based on Stantec Data by Landuse. Applied 8.85% reduction from TDM measures.

Vechicle Emission Factors - CO2 EF accounts for Pavley, LCFS, and ACC.

Vechicle Emission Factors -

Vechicle Emission Factors -

Woodstoves - Based on Client information, no woodstoves and no wood burning fireplaces.

Energy Use - 2013 T24 for electricity and NG. 25% and 30% better for res and non-res as compared to 2008 T24

Water And Wastewater - Total Indoor and Outdoor water use based on Client Data. Distributed between land uses based on default CalEEMod distribution.

Solid Waste - Defaults

Land Use Change - Based on Client Data

Sequestration - Based on client Data

Energy Mitigation - Based on Client data. 2 kW panel per single family home, 2 kW panel per 1600 SF commercial space.

Water Mitigation - Based on Client Data

Operational Off-Road Equipment -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2318202	2318201
tblConstructionPhase	NumDays	300.00	1.00
tblEnergyUse	T24E	269.81	202.36
tblEnergyUse	T24E	269.81	202.36
tblEnergyUse	T24E	5.62	3.93
tblEnergyUse	T24E	2.75	1.93
tblEnergyUse	T24E	4.90	3.43
tblEnergyUse	T24E	596.10	447.08
tblEnergyUse	T24E	4.90	3.43
tblEnergyUse	T24NG	11,455.03	8,591.27
tblEnergyUse	T24NG	11,455.03	8,591.27
tblEnergyUse	T24NG	10.54	7.38

tblEnergyUse	T24NG	14.36	10.05
tblEnergyUse	T24NG	1.21	0.85
tblEnergyUse	T24NG	23,944.02	17,958.02
tblEnergyUse	T24NG	1.21	0.85
tblFireplaces	NumberGas	595.00	630.00
tblFireplaces	NumberGas	454.75	481.50
tblFireplaces	NumberGas	288.15	305.10
tblFireplaces	NumberWood	35.00	0.00
tblFireplaces	NumberWood	26.75	0.00
tblFireplaces	NumberWood	16.95	0.00
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07
tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	CO2IntensityFactor	630.89	501.88
tblProjectCharacteristics	OperationalYear	2014	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSequestration	NumberOfNewTrees	0.00	3,911.00
tblSequestration	NumberOfNewTrees	0.00	89.00
tblSolidWaste	SolidWasteGenerationRate	0.48	59.13
tblSolidWaste	SolidWasteGenerationRate	322.00	3,262.22

tblSolidWaste	SolidWasteGenerationRate	246.10	2,492.44
tblSolidWaste	SolidWasteGenerationRate	136.88	230.26
tblSolidWaste	SolidWasteGenerationRate	404.55	4,885.92
tblSolidWaste	SolidWasteGenerationRate	14.25	3.94
tblSolidWaste	SolidWasteGenerationRate	294.00	3,145.72
tblSolidWaste	SolidWasteGenerationRate	466.99	1,579.79
tblSolidWaste	SolidWasteGenerationRate	15.75	169.51
tblVehicleEF	LDA	257.96	247.65
tblVehicleEF	LDA	53.04	51.45
tblVehicleEF	LDT1	318.76	315.02
tblVehicleEF	LDT1	64.29	63.70
tblVehicleEF	LDT2	384.11	378.07
tblVehicleEF	LDT2	77.68	76.70
tblVehicleEF	MDV	510.84	504.24
tblVehicleEF	MDV	103.50	102.54
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	30.00	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	64.10	0.00
tblVehicleTrips	CC_TTP	64.70	0.00
tblVehicleTrips	CC_TTP	64.40	0.00
tblVehicleTrips	CNW_TL	7.90	0.00

tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	5.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	65.00	100.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	16.90	100.00
tblVehicleTrips	CW_TTP	16.30	100.00
tblVehicleTrips	CW_TTP	16.60	100.00
tblVehicleTrips	DV_TP	28.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00

tblVehicleTrips	DV_TP	25.00	0.00
tblVehicleTrips	DV_TP	19.00	0.00
tblVehicleTrips	DV_TP	39.00	0.00
tblVehicleTrips	DV_TP	35.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	40.00	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	PB_TP	6.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	12.00	0.00
tblVehicleTrips	PB_TP	4.00	0.00
tblVehicleTrips	PB_TP	9.00	0.00

tblVehicleTrips	PB_TP	11.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	15.00	0.00
tblVehicleTrips	PR_TP	66.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	63.00	100.00
tblVehicleTrips	PR_TP	77.00	100.00
tblVehicleTrips	PR_TP	52.00	100.00
tblVehicleTrips	PR_TP	0.00	100.00
tblVehicleTrips	PR_TP	54.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	45.00	100.00
tblVehicleTrips	PR_TP	0.00	100.00
tblVehicleTrips	ST_TR	1.59	1.96
tblVehicleTrips	ST_TR	7.16	8.16
tblVehicleTrips	ST_TR	7.16	8.16
tblVehicleTrips	ST_TR	2.37	2.18
tblVehicleTrips	ST_TR	20.87	1.44
tblVehicleTrips	ST_TR	49.97	55.24
tblVehicleTrips	ST_TR	10.08	7.91
tblVehicleTrips	ST_TR	42.04	70.80
tblVehicleTrips	SU_TR	1.59	1.96
tblVehicleTrips	SU_TR	6.07	6.92
tblVehicleTrips	SU_TR	6.07	6.92
tblVehicleTrips	SU_TR	0.98	0.90
tblVehicleTrips	SU_TR	26.73	1.85
tblVehicleTrips	SU_TR	25.24	27.90
tblVehicleTrips	SU_TR	8.77	6.88
tblVehicleTrips	SU_TR	20.43	34.41

tblVehicleTrips	WD_TR	1.59	1.96
tblVehicleTrips	WD_TR	6.59	7.51
tblVehicleTrips	WD_TR	6.59	7.51
tblVehicleTrips	WD_TR	1.29	1.13
tblVehicleTrips	WD_TR	11.01	10.14
tblVehicleTrips	WD_TR	32.93	2.28
tblVehicleTrips	WD_TR	42.94	47.47
tblVehicleTrips	WD_TR	9.57	7.51
tblVehicleTrips	WD_TR	44.32	74.64
tblWater	IndoorWaterUseRate	45,607,817.94	20,129,663.84
tblWater	IndoorWaterUseRate	34,857,403.71	15,384,814.51
tblWater	IndoorWaterUseRate	1,818,180.00	802,479.79
tblWater	IndoorWaterUseRate	77,314,180.38	34,123,721.14
tblWater	IndoorWaterUseRate	147,857.86	64,945,815.15
tblWater	IndoorWaterUseRate	20,740,306.02	9,154,031.19
tblWater	IndoorWaterUseRate	22,087,214.69	9,748,508.63
tblWater	IndoorWaterUseRate	1,111,087.82	490,394.53
tblWater	OutdoorWaterUseRate	6,672,295.56	30,931,089.44
tblWater	OutdoorWaterUseRate	28,752,754.79	41,239,069.15
tblWater	OutdoorWaterUseRate	21,975,319.73	31,518,431.42
tblWater	OutdoorWaterUseRate	4,675,320.00	6,705,647.73
tblWater	OutdoorWaterUseRate	47,386,110.55	67,964,238.70
tblWater	OutdoorWaterUseRate	90,622.56	129,976.76
tblWater	OutdoorWaterUseRate	12,711,800.46	18,232,090.18
tblWater	OutdoorWaterUseRate	13,924,548.39	19,971,492.06
tblWater	OutdoorWaterUseRate	680,989.31	976,719.12
tblWoodstoves	NumberCatalytic	35.00	0.00
tblWoodstoves	NumberCatalytic	26.75	0.00
tblWoodstoves	NumberCatalytic	16.95	0.00
tblWoodstoves	NumberNoncatalytic	35.00	0.00

tblWoodstoves	NumberNoncatalytic	26.75	0.00
tblWoodstoves	NumberNoncatalytic	16.95	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	2.3400e-003	0.0249	0.0189	2.0000e-005	1.1000e-004	1.2600e-003	1.3800e-003	3.0000e-005	1.1800e-003	1.2100e-003	0.0000	2.0034	2.0034	5.2000e-004	0.0000	2.0143
Total	**2.3400e-003**	**0.0249**	**0.0189**	**2.0000e-005**	**1.1000e-004**	**1.2600e-003**	**1.3800e-003**	**3.0000e-005**	**1.1800e-003**	**1.2100e-003**	**0.0000**	**2.0034**	**2.0034**	**5.2000e-004**	**0.0000**	**2.0143**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	2.3400e-003	0.0249	0.0189	2.0000e-005	1.1000e-004	1.2600e-003	1.3800e-003	3.0000e-005	1.1800e-003	1.2100e-003	0.0000	2.0034	2.0034	5.2000e-004	0.0000	2.0143
Total	**2.3400e-003**	**0.0249**	**0.0189**	**2.0000e-005**	**1.1000e-004**	**1.2600e-003**	**1.3800e-003**	**3.0000e-005**	**1.1800e-003**	**1.2100e-003**	**0.0000**	**2.0034**	**2.0034**	**5.2000e-004**	**0.0000**	**2.0143**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.1525	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Energy	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	6,071.2677	6,071.2677	0.2955	0.0817	6,102.8047
Mobile	16.5120	53.3631	202.3673	0.6287	41.9048	0.8689	42.7737	11.2249	0.8013	12.0261	0.0000	43,462.5277	43,462.5277	1.6383	0.0000	43,496.9312
Waste						0.0000	0.0000		0.0000	0.0000	3,213.1297	0.0000	3,213.1297	189.8905	0.0000	7,200.8308
Water						0.0000	0.0000		0.0000	0.0000	49.1044	1,009.3232	1,058.4276	5.1018	0.1312	1,206.2234
Total	**33.8091**	**54.8011**	**219.3210**	**0.6374**	**41.9048**	**1.0822**	**42.9870**	**11.2249**	**1.0144**	**12.2393**	**3,262.2341**	**50,909.8945**	**54,172.1286**	**196.9587**	**0.2191**	**58,376.1840**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.1525	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Energy	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	6,071.2677	6,071.2677	0.2955	0.0817	6,102.8047
Mobile	16.5120	53.3631	202.3673	0.6287	41.9048	0.8689	42.7737	11.2249	0.8013	12.0261	0.0000	43,462.5277	43,462.5277	1.6383	0.0000	43,496.9312
Waste						0.0000	0.0000		0.0000	0.0000	803.2824	0.0000	803.2824	47.4726	0.0000	1,800.2077

Water						0.0000	0.0000		0.0000	0.0000	49.1044	1,009.3232	1,058.4276	5.1009	0.1310	1,206.1451
Total	**33.8091**	**54.8011**	**219.3210**	**0.6374**	**41.9048**	**1.0822**	**42.9870**	**11.2249**	**1.0144**	**12.2393**	**852.3868**	**50,909.8945**	**51,762.2813**	**54.5399**	**0.2189**	**52,975.4825**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**73.87**	**0.00**	**4.45**	**72.31**	**0.09**	**9.25**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	2,836.8060
Vegetation Land Change	-4,114.3010
Total	**-1,277.4950**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/1/2014	5	1	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	19.80	7.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0248	0.0181	2.0000e-005		1.2600e-003	1.2600e-003		1.1800e-003	1.1800e-003	0.0000	1.8888	1.8888	5.1000e-004	0.0000	1.8995
Total	**2.3000e-003**	**0.0248**	**0.0181**	**2.0000e-005**		**1.2600e-003**	**1.2600e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**1.8888**	**1.8888**	**5.1000e-004**	**0.0000**	**1.8995**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	8.0000e-005	8.0000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1146	0.1146	1.0000e-005	0.0000	0.1147
Total	**5.0000e-005**	**8.0000e-005**	**8.0000e-004**	**0.0000**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1146**	**0.1146**	**1.0000e-005**	**0.0000**	**0.1147**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3000e-003	0.0248	0.0181	2.0000e-005		1.2600e-003	1.2600e-003		1.1800e-003	1.1800e-003	0.0000	1.8888	1.8888	5.1000e-004	0.0000	1.8995
Total	**2.3000e-003**	**0.0248**	**0.0181**	**2.0000e-005**		**1.2600e-003**	**1.2600e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**1.8888**	**1.8888**	**5.1000e-004**	**0.0000**	**1.8995**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	8.0000e-005	8.0000e-004	0.0000	1.1000e-004	0.0000	1.1000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1146	0.1146	1.0000e-005	0.0000	0.1147
Total	**5.0000e-005**	**8.0000e-005**	**8.0000e-004**	**0.0000**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1146**	**0.1146**	**1.0000e-005**	**0.0000**	**0.1147**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	16.5120	53.3631	202.3673	0.6287	41.9048	0.8689	42.7737	11.2249	0.8013	12.0261	0.0000	43,462.5277	43,462.5277	1.6383	0.0000	43,496.9312
Mitigated	16.5120	53.3631	202.3673	0.6287	41.9048	0.8689	42.7737	11.2249	0.8013	12.0261	0.0000	43,462.5277	43,462.5277	1.6383	0.0000	43,496.9312

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	10.98	10.98	10.98	40,432	40,432
Condo/Townhouse	5,257.00	5,712.00	4844.00	20,000,242	20,000,242
Condo/Townhouse High Rise	4,017.85	4,365.60	3702.20	15,285,899	15,285,899
Elementary School	847.50	0.00	0.00	2,229,942	2,229,942
General Office Building	4,410.90	948.30	391.50	12,311,016	12,311,016
Health Club	5.70	3.60	4.63	19,326	19,326
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	13,291.60	15,467.20	7812.00	47,223,304	47,223,304
Single Family Housing	2,545.89	2,681.49	2332.32	9,632,461	9,632,461
Strip Mall	1,119.60	1,062.00	516.15	3,776,377	3,776,377
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	31,507.02	30,251.17	19,613.77	110,519,000	110,519,000

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse High Rise	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Elementary School	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
General Office Building	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Health Club	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	100	0	0
Regional Shopping Center	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Single Family Housing	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Strip Mall	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Unenclosed Parking with	0.00	0.00	0.00	0.00	0.00	0.00	100	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.530094	0.057664	0.178835	0.124843	0.039181	0.006319	0.017052	0.034445	0.002509	0.003148	0.003693	0.000531	0.001685

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
NaturalGas Unmitigated	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	1,431.3406	1,431.3406	0.0274	0.0262	1,440.0515
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	4,639.9271	4,639.9271	0.2681	0.0555	4,662.7532

Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	4,639.9271	4,639.9271	0.2681	0.0555	4,662.7532
NaturalGas Mitigated	0.1446	1.2492	0.6229	7.8900e-003		0.0999	0.0999		0.0999	0.0999	0.0000	1,431.3406	1,431.3406	0.0274	0.0262	1,440.0515

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	8.07959e+006	0.0436	0.3723	0.1584	2.3800e-003		0.0301	0.0301		0.0301	0.0301	0.0000	431.1576	431.1576	8.2600e-003	7.9000e-003	433.7816
Condo/Townhouse High Rise	6.17511e+006	0.0333	0.2845	0.1211	1.8200e-003		0.0230	0.0230		0.0230	0.0230	0.0000	329.5276	329.5276	6.3200e-003	6.0400e-003	331.5331
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	3.37995e+006	0.0182	0.1657	0.1392	9.9000e-004		0.0126	0.0126		0.0126	0.0126	0.0000	180.3670	180.3670	3.4600e-003	3.3100e-003	181.4647
Health Club	36250	2.0000e-004	1.7800e-003	1.4900e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.4000e-004	1.4000e-004	0.0000	1.9344	1.9344	4.0000e-005	4.0000e-005	1.9462
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	375200	2.0200e-003	0.0184	0.0155	1.1000e-004		1.4000e-003	1.4000e-003		1.4000e-003	1.4000e-003	0.0000	20.0221	20.0221	3.8000e-004	3.7000e-004	20.1440
Single Family Housing	8.07326e+006	0.0435	0.3720	0.1583	2.3700e-003		0.0301	0.0301		0.0301	0.0301	0.0000	430.8202	430.8202	8.2600e-003	7.9000e-003	433.4421
Strip Mall	20100	1.1000e-004	9.9000e-004	8.3000e-004	1.0000e-005		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005	0.0000	1.0726	1.0726	2.0000e-005	2.0000e-005	1.0791
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1446**	**1.2491**	**0.6229**	**7.8900e-003**		**0.0999**	**0.0999**		**0.0999**	**0.0999**	**0.0000**	**1,431.3406**	**1,431.3406**	**0.0274**	**0.0263**	**1,440.0515**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	8.07959e+006	0.0436	0.3723	0.1584	2.3800e-003		0.0301	0.0301		0.0301	0.0301	0.0000	431.1576	431.1576	8.2600e-003	7.9000e-003	433.7816
Condo/Townhouse High Rise	6.17511e+006	0.0333	0.2845	0.1211	1.8200e-003		0.0230	0.0230		0.0230	0.0230	0.0000	329.5276	329.5276	6.3200e-003	6.0400e-003	331.5331
Elementary School	682841	3.6800e-003	0.0335	0.0281	2.0000e-004		2.5400e-003	2.5400e-003		2.5400e-003	2.5400e-003	0.0000	36.4390	36.4390	7.0000e-004	6.7000e-004	36.6608
General Office Building	3.37995e+006	0.0182	0.1657	0.1392	9.9000e-004		0.0126	0.0126		0.0126	0.0126	0.0000	180.3670	180.3670	3.4600e-003	3.3100e-003	181.4647
Health Club	36250	2.0000e-004	1.7800e-003	1.4900e-003	1.0000e-005		1.4000e-004	1.4000e-004		1.4000e-004	1.4000e-004	0.0000	1.9344	1.9344	4.0000e-005	4.0000e-005	1.9462
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	375200	2.0200e-003	0.0184	0.0155	1.1000e-004		1.4000e-003	1.4000e-003		1.4000e-003	1.4000e-003	0.0000	20.0221	20.0221	3.8000e-004	3.7000e-004	20.1440
Single Family Housing	8.07326e+006	0.0435	0.3720	0.1583	2.3700e-003		0.0301	0.0301		0.0301	0.0301	0.0000	430.8202	430.8202	8.2600e-003	7.9000e-003	433.4421
Strip Mall	20100	1.1000e-004	9.9000e-004	8.3000e-004	1.0000e-005		7.0000e-005	7.0000e-005		7.0000e-005	7.0000e-005	0.0000	1.0726	1.0726	2.0000e-005	2.0000e-005	1.0791
Unenclosed Parking with	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1446**	**1.2491**	**0.6229**	**7.8900e-003**		**0.0999**	**0.0999**		**0.0999**	**0.0999**	**0.0000**	**1,431.3406**	**1,431.3406**	**0.0274**	**0.0263**	**1,440.0515**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000

Condo/Townhouse	3.0313e+006	690.0725	0.0399	8.2500e-003	693.4673
Condo/Townhouse High Rise	2.31678e+006	527.4125	0.0305	6.3100e-003	530.0071
Elementary School	420114	95.6384	5.5300e-003	1.1400e-003	96.1089
General Office Building	5.5854e+006	1,271.5104	0.0735	0.0152	1,277.7656
Health Club	28075	6.3912	3.7000e-004	8.0000e-005	6.4227
Parking Lot	465360	105.9388	6.1200e-003	1.2700e-003	106.4599
Regional Shopping Center	3.836e+006	873.2613	0.0505	0.0104	877.5573
Single Family Housing	2.4224e+006	551.4574	0.0319	6.5900e-003	554.1703
Strip Mall	205500	46.7819	2.7000e-003	5.6000e-004	47.0120
Unenclosed Parking with Elevator	2.07101e+006	471.4628	0.0272	5.6400e-003	473.7821
Total		**4,639.9271**	**0.2681**	**0.0555**	**4,662.7532**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.0313e+006	690.0725	0.0399	8.2500e-003	693.4673
Condo/Townhouse High Rise	2.31678e+006	527.4125	0.0305	6.3100e-003	530.0071
Elementary School	420114	95.6384	5.5300e-003	1.1400e-003	96.1089
General Office Building	5.5854e+006	1,271.5104	0.0735	0.0152	1,277.7656
Health Club	28075	6.3912	3.7000e-004	8.0000e-005	6.4227

Parking Lot	465360	105.9388	6.1200e-003	1.2700e-003	106.4599
Regional Shopping Center	3.836e+006	873.2613	0.0505	0.0104	877.5573
Single Family Housing	2.4224e+006	551.4574	0.0319	6.5900e-003	554.1703
Strip Mall	205500	46.7819	2.7000e-003	5.6000e-004	47.0120
Unenclosed Parking with Elevator	2.07101e+006	471.4628	0.0272	5.6400e-003	473.7821
Total		**4,639.9271**	**0.2681**	**0.0555**	**4,662.7532**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	17.1525	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Mitigated	17.1525	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.5124					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0344	0.0000	1.8700e-003	0.0000		0.0238	0.0238		0.0235	0.0235	0.0000	340.1783	340.1783	6.5200e-003	6.2400e-003	342.2485
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.1525**	**0.1888**	**16.3308**	**8.6000e-004**		**0.1135**	**0.1135**		**0.1132**	**0.1132**	**0.0000**	**366.7760**	**366.7760**	**0.0326**	**6.2400e-003**	**369.3938**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.5124					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0344	0.0000	1.8700e-003	0.0000		0.0238	0.0238		0.0235	0.0235	0.0000	340.1783	340.1783	6.5200e-003	6.2400e-003	342.2485
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.1525**	**0.1888**	**16.3308**	**8.6000e-004**		**0.1135**	**0.1135**		**0.1132**	**0.1132**	**0.0000**	**366.7760**	**366.7760**	**0.0326**	**6.2400e-003**	**369.3938**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Unmitigated	1,058.4276	5.1018	0.1312	1,206.2234

Mitigated	1,058.4276	5.1009	0.1310	1,206.1451

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 30.9311	78.2303	4.5200e-003	9.4000e-004	78.6151
Condo/Townhouse	20.1297 / 41.2391	170.3559	0.6654	0.0175	189.7382
Condo/Townhouse High Rise	15.3848 / 31.5184	130.2006	0.5086	0.0133	145.0142
Elementary School	0.80248 / 6.70565	19.5931	0.0273	8.5000e-004	20.4288
General Office Building	34.1237 / 67.9642	283.8698	1.1277	0.0295	316.7024
Health Club	64.9458 / 0.129977	213.4465	2.1274	0.0523	274.3272
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	9.15403 / 18.2321	76.1509	0.3025	7.9200e-003	84.9586
Single Family Housing	9.74851 / 19.9715	82.5009	0.3222	8.4500e-003	91.8875
Strip Mall	0.490395 / 0.976719	4.0795	0.0162	4.2000e-004	4.5514
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,058.4276**	**5.1018**	**0.1312**	**1,206.2234**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 30.9311	78.2303	4.5200e-003	9.4000e-004	78.6151
Condo/Townhouse	20.1297 / 41.2391	170.3559	0.6653	0.0174	189.7280
Condo/Townhouse High Rise	15.3848 / 31.5184	130.2006	0.5085	0.0133	145.0064
Elementary School	0.80248 / 6.70565	19.5931	0.0273	8.5000e-004	20.4284
General Office Building	34.1237 / 67.9642	283.8698	1.1275	0.0295	316.6851
Health Club	64.9458 / 0.129977	213.4465	2.1270	0.0522	274.2944
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	9.15403 / 18.2321	76.1509	0.3025	7.9100e-003	84.9540
Single Family Housing	9.74851 / 19.9715	82.5009	0.3222	8.4400e-003	91.8826
Strip Mall	0.490395 / 0.976719	4.0795	0.0162	4.2000e-004	4.5511
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,058.4276**	**5.1009**	**0.1310**	**1,206.1451**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	803.2824	47.4726	0.0000	1,800.2077
Unmitigated	3,213.1297	189.8905	0.0000	7,200.8308

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	59.13	12.0029	0.7094	0.0000	26.8992
Condo/Townhouse	3262.22	662.2012	39.1350	0.0000	1,484.0355
Condo/Townhouse High Rise	2492.44	505.9428	29.9004	0.0000	1,133.8504
Elementary School	230.26	46.7407	2.7623	0.0000	104.7489
General Office Building	4885.92	991.7976	58.6136	0.0000	2,222.6824
Health Club	3.94	0.7998	0.0473	0.0000	1.7924
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3145.72	638.5527	37.7374	0.0000	1,431.0378
Single Family Housing	1579.79	320.6831	18.9518	0.0000	718.6715
Strip Mall	169.51	34.4090	2.0335	0.0000	77.1128
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000

Total		**3,213.1298**	**189.8905**	**0.0000**	**7,200.8308**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	14.7825	3.0007	0.1773	0.0000	6.7248
Condo/Townhouse	815.555	165.5503	9.7837	0.0000	371.0089
Condo/Townhouse High Rise	623.11	126.4857	7.4751	0.0000	283.4626
Elementary School	57.565	11.6852	0.6906	0.0000	26.1872
General Office Building	1221.48	247.9494	14.6534	0.0000	555.6706
Health Club	0.985	0.2000	0.0118	0.0000	0.4481
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	786.43	159.6382	9.4344	0.0000	357.7595
Single Family Housing	394.947	80.1708	4.7380	0.0000	179.6679
Strip Mall	42.3775	8.6023	0.5084	0.0000	19.2782
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**803.2824**	**47.4726**	**0.0000**	**1,800.2077**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
	0	0.00	0			Diesel

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	-1,277.4950	0.0000	0.0000	-1,277.4950

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Cropland	7.4 / 0	-45.8800	0.0000	0.0000	-45.8800
Grassland	39.1 / 0	-168.5210	0.0000	0.0000	-168.5210
Others	107.5 / 0	0.0000	0.0000	0.0000	0.0000
Scrub	244 / 0	-3,489.2000	0.0000	0.0000	-3,489.2000
Trees	3.7 / 0	-410.7000	0.0000	0.0000	-410.7000
Wetlands	17.1 / 0	0.0000	0.0000	0.0000	0.0000
Total		**-4,114.3010**	**0.0000**	**0.0000**	**-4,114.3010**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Miscellaneous	3911	2,768.9880	0.0000	0.0000	2,768.9880
True Fir/Hemlock	89	67.8180	0.0000	0.0000	67.8180
Total		**2,836.8060**	**0.0000**	**0.0000**	**2,836.8060**

Entrada South (Operational) - Scenario 3 - CARB 2020 NAT

Los Angeles-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	435.00	1000sqft	28.07	435,000.00	0
Elementary School	750.00	Student	9.40	62,703.53	0
Parking Lot	12.14	Acre	12.14	528,818.40	0
Unenclosed Parking with Elevator	1,836.00	Space	16.52	734,400.00	0
City Park	5.60	Acre	5.60	0.00	0
Health Club	2.50	1000sqft	2.90	2,500.00	0
Condo/Townhouse	700.00	Dwelling Unit	59.00	700,000.00	2352
Condo/Townhouse High Rise	535.00	Dwelling Unit	18.00	535,000.00	1797
Single Family Housing	339.00	Dwelling Unit	53.40	610,200.00	1139
Regional Shopping Center	280.00	1000sqft	18.07	280,000.00	0
Strip Mall	15.00	1000sqft	0.97	15,000.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	33
Climate Zone	9			**Operational Year**	2020
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - No RPS

Land Use - Based on Project Description and Client Data

Construction Phase - No Construction information evaluated (Operational Run only)

Trips and VMT -

Grading - Client Provided Data

Vehicle Trips - Based on Stantec Data by Landuse. Applied 0.02% reduction from TDM measure (telecommuting).

Vechicle Emission Factors - CO2 EF adjusted to remove benefit from Pavley and LCFS.

Vechicle Emission Factors -

Vechicle Emission Factors -

Woodstoves - Based on Client information, no woodstoves and no wood burning fireplaces.

Energy Use - 2005 T24 for electricity and NG. Checked historical energy use

Water And Wastewater - Total Indoor and Outdoor water use based on Client Data. Distributed between land uses based on default CalEEMod distribution.

Solid Waste - Defaults

Land Use Change - Based on Client Data

Sequestration - Based on client Data

Energy Mitigation - No Rewable Energy

Water Mitigation - Based on Client Data

Operational Off-Road Equipment -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Interior	2318202	2684105
tblConstructionPhase	NumDays	300.00	1.00
tblConstructionPhase	PhaseEndDate	1/1/2015	2/24/2016
tblFireplaces	NumberGas	595.00	630.00
tblFireplaces	NumberGas	454.75	481.50
tblFireplaces	NumberGas	288.15	305.10
tblFireplaces	NumberWood	35.00	0.00
tblFireplaces	NumberWood	26.75	0.00
tblFireplaces	NumberWood	16.95	0.00
tblLandUse	LandUseSquareFeet	62,702.53	62,703.53
tblLandUse	LandUseSquareFeet	243,936.00	0.00
tblLandUse	LotAcreage	9.99	28.07

tblLandUse	LotAcreage	1.44	9.40
tblLandUse	LotAcreage	0.06	2.90
tblLandUse	LotAcreage	43.75	59.00
tblLandUse	LotAcreage	8.36	18.00
tblLandUse	LotAcreage	110.06	53.40
tblLandUse	LotAcreage	6.43	18.07
tblLandUse	LotAcreage	0.34	0.97
tblLandUse	Population	2,002.00	2,352.00
tblLandUse	Population	1,530.00	1,797.00
tblLandUse	Population	970.00	1,139.00
tblProjectCharacteristics	OperationalYear	2014	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSequestration	NumberOfNewTrees	0.00	3,911.00
tblSequestration	NumberOfNewTrees	0.00	89.00
tblSolidWaste	SolidWasteGenerationRate	0.48	59.13
tblSolidWaste	SolidWasteGenerationRate	322.00	3,262.22
tblSolidWaste	SolidWasteGenerationRate	246.10	2,492.44
tblSolidWaste	SolidWasteGenerationRate	136.88	230.26
tblSolidWaste	SolidWasteGenerationRate	404.55	4,885.92
tblSolidWaste	SolidWasteGenerationRate	14.25	3.94
tblSolidWaste	SolidWasteGenerationRate	294.00	3,145.72
tblSolidWaste	SolidWasteGenerationRate	466.99	1,579.79
tblSolidWaste	SolidWasteGenerationRate	15.75	169.51
tblTripsAndVMT	VendorTripLength	7.90	6.90
tblTripsAndVMT	WorkerTripLength	19.80	14.70
tblVehicleEF	HHD	528.22	586.91
tblVehicleEF	HHD	1,543.87	1,715.41
tblVehicleEF	HHD	49.88	55.43
tblVehicleEF	LDA	257.96	370.25
tblVehicleEF	LDA	53.04	73.73

tblVehicleEF	LDT1	318.76	427.21
tblVehicleEF	LDT1	64.29	84.57
tblVehicleEF	LDT2	384.11	503.98
tblVehicleEF	LDT2	77.68	100.47
tblVehicleEF	LHD1	7.51	8.35
tblVehicleEF	LHD1	547.43	608.26
tblVehicleEF	LHD1	44.67	49.63
tblVehicleEF	LHD2	8.23	9.14
tblVehicleEF	LHD2	524.55	582.84
tblVehicleEF	LHD2	32.59	36.21
tblVehicleEF	MCY	141.51	157.23
tblVehicleEF	MCY	38.62	42.91
tblVehicleEF	MDV	510.84	642.35
tblVehicleEF	MDV	103.50	127.26
tblVehicleEF	MH	608.18	675.75
tblVehicleEF	MH	29.11	32.35
tblVehicleEF	MHD	572.02	635.57
tblVehicleEF	MHD	920.56	1,022.84
tblVehicleEF	MHD	49.58	55.09
tblVehicleEF	OBUS	534.88	594.31
tblVehicleEF	OBUS	1,042.06	1,157.85
tblVehicleEF	OBUS	32.77	36.42
tblVehicleEF	SBUS	547.00	607.77
tblVehicleEF	SBUS	1,045.89	1,162.10
tblVehicleEF	SBUS	115.65	128.50
tblVehicleEF	UBUS	2,019.15	2,243.50
tblVehicleEF	UBUS	19.75	21.95
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00

tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TL	10.10	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	30.00	0.00
tblVehicleTrips	CC_TTP	48.00	0.00
tblVehicleTrips	CC_TTP	64.10	0.00
tblVehicleTrips	CC_TTP	64.70	0.00
tblVehicleTrips	CC_TTP	64.40	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TL	7.90	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	5.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CNW_TTP	19.00	0.00
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00

tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	10.12
tblVehicleTrips	CW_TL	18.50	0.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	65.00	100.00
tblVehicleTrips	CW_TTP	33.00	100.00
tblVehicleTrips	CW_TTP	16.90	100.00
tblVehicleTrips	CW_TTP	16.30	100.00
tblVehicleTrips	CW_TTP	16.60	100.00
tblVehicleTrips	DV_TP	28.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	25.00	0.00
tblVehicleTrips	DV_TP	19.00	0.00
tblVehicleTrips	DV_TP	39.00	0.00
tblVehicleTrips	DV_TP	35.00	0.00
tblVehicleTrips	DV_TP	11.00	0.00
tblVehicleTrips	DV_TP	40.00	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TL	12.90	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HO_TTP	40.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TL	9.60	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00
tblVehicleTrips	HS_TTP	19.20	0.00

tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TL	19.80	10.44
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	HW_TTP	40.20	100.00
tblVehicleTrips	PB_TP	6.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	12.00	0.00
tblVehicleTrips	PB_TP	4.00	0.00
tblVehicleTrips	PB_TP	9.00	0.00
tblVehicleTrips	PB_TP	11.00	0.00
tblVehicleTrips	PB_TP	3.00	0.00
tblVehicleTrips	PB_TP	15.00	0.00
tblVehicleTrips	PR_TP	66.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	63.00	100.00
tblVehicleTrips	PR_TP	77.00	100.00
tblVehicleTrips	PR_TP	52.00	100.00
tblVehicleTrips	PR_TP	0.00	100.00
tblVehicleTrips	PR_TP	54.00	100.00
tblVehicleTrips	PR_TP	86.00	100.00
tblVehicleTrips	PR_TP	45.00	100.00
tblVehicleTrips	PR_TP	0.00	100.00
tblVehicleTrips	ST_TR	1.59	1.96
tblVehicleTrips	ST_TR	7.16	8.14
tblVehicleTrips	ST_TR	7.16	8.14
tblVehicleTrips	ST_TR	2.37	2.18

tblVehicleTrips	ST_TR	20.87	1.44
tblVehicleTrips	ST_TR	49.97	55.13
tblVehicleTrips	ST_TR	10.08	7.89
tblVehicleTrips	ST_TR	42.04	70.66
tblVehicleTrips	SU_TR	1.59	1.96
tblVehicleTrips	SU_TR	6.07	6.90
tblVehicleTrips	SU_TR	6.07	6.90
tblVehicleTrips	SU_TR	0.98	0.90
tblVehicleTrips	SU_TR	26.73	1.84
tblVehicleTrips	SU_TR	25.24	27.85
tblVehicleTrips	SU_TR	8.77	6.87
tblVehicleTrips	SU_TR	20.43	34.34
tblVehicleTrips	WD_TR	1.59	1.96
tblVehicleTrips	WD_TR	6.59	7.49
tblVehicleTrips	WD_TR	6.59	7.49
tblVehicleTrips	WD_TR	1.29	1.13
tblVehicleTrips	WD_TR	11.01	10.12
tblVehicleTrips	WD_TR	32.93	2.27
tblVehicleTrips	WD_TR	42.94	47.38
tblVehicleTrips	WD_TR	9.57	7.49
tblVehicleTrips	WD_TR	44.32	74.49
tblWater	IndoorWaterUseRate	45,607,817.94	24,155,596.61
tblWater	IndoorWaterUseRate	34,857,403.71	18,461,777.41
tblWater	IndoorWaterUseRate	1,818,180.00	962,975.75
tblWater	IndoorWaterUseRate	77,314,180.38	40,948,465.36
tblWater	IndoorWaterUseRate	147,857.86	77,934,978.18
tblWater	IndoorWaterUseRate	20,740,306.02	10,984,837.43
tblWater	IndoorWaterUseRate	22,087,214.69	11,698,210.36
tblWater	IndoorWaterUseRate	1,111,087.82	588,473.43
tblWater	OutdoorWaterUseRate	6,672,295.56	30,931,089.44

tblWater	OutdoorWaterUseRate	28,752,754.79	41,239,069.15
tblWater	OutdoorWaterUseRate	21,975,319.73	31,518,431.42
tblWater	OutdoorWaterUseRate	4,675,320.00	6,705,647.73
tblWater	OutdoorWaterUseRate	47,386,110.55	67,964,238.70
tblWater	OutdoorWaterUseRate	90,622.56	129,976.76
tblWater	OutdoorWaterUseRate	12,711,800.46	18,232,090.18
tblWater	OutdoorWaterUseRate	13,924,548.39	19,971,492.06
tblWater	OutdoorWaterUseRate	680,989.31	976,719.12
tblWoodstoves	NumberCatalytic	35.00	0.00
tblWoodstoves	NumberCatalytic	26.75	0.00
tblWoodstoves	NumberCatalytic	16.95	0.00
tblWoodstoves	NumberNoncatalytic	35.00	0.00
tblWoodstoves	NumberNoncatalytic	26.75	0.00
tblWoodstoves	NumberNoncatalytic	16.95	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.5978	6.3252	4.8515	5.4800e-003	0.0215	0.3201	0.3415	5.7000e-003	0.2985	0.3042	0.0000	510.2625	510.2625	0.1337	0.0000	513.0711
2016	0.0849	0.8922	0.7026	8.2000e-004	3.2100e-003	0.0447	0.0479	8.5000e-004	0.0417	0.0425	0.0000	75.4675	75.4675	0.0199	0.0000	75.8844
Total	**0.6827**	**7.2173**	**5.5541**	**6.3000e-003**	**0.0247**	**0.3648**	**0.3894**	**6.5500e-003**	**0.3402**	**0.3467**	**0.0000**	**585.7300**	**585.7300**	**0.1536**	**0.0000**	**588.9555**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	0.5978	6.3252	4.8515	5.4800e-003	0.0215	0.3201	0.3415	5.7000e-003	0.2985	0.3042	0.0000	510.2620	510.2620	0.1337	0.0000	513.0706
2016	0.0849	0.8922	0.7026	8.2000e-004	3.2100e-003	0.0447	0.0479	8.5000e-004	0.0417	0.0425	0.0000	75.4674	75.4674	0.0199	0.0000	75.8843
Total	**0.6827**	**7.2173**	**5.5541**	**6.3000e-003**	**0.0247**	**0.3648**	**0.3894**	**6.5500e-003**	**0.3402**	**0.3467**	**0.0000**	**585.7294**	**585.7294**	**0.1536**	**0.0000**	**588.9548**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.3645	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Energy	0.1973	1.7062	0.8629	0.0108		0.1363	0.1363		0.1363	0.1363	0.0000	8,361.6027	8,361.6027	0.3320	0.0968	8,398.5685
Mobile	16.4765	53.2482	201.9314	0.6273	41.8145	0.8670	42.6815	11.2007	0.7995	12.0002	0.0000	57,161.4259	57,161.4259	1.6347	0.0000	57,195.7553
Waste						0.0000	0.0000		0.0000	0.0000	3,213.1297	0.0000	3,213.1297	189.8905	0.0000	7,200.8308
Water						0.0000	0.0000		0.0000	0.0000	58.9253	1,384.1204	1,443.0456	6.1158	0.1561	1,619.8590
Total	**34.0383**	**55.1431**	**219.1252**	**0.6389**	**41.8145**	**1.1168**	**42.9313**	**11.2007**	**1.0491**	**12.2498**	**3,272.0550**	**67,273.9249**	**70,545.9799**	**198.0057**	**0.2591**	**74,784.4074**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	17.3645	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Energy	0.1973	1.7062	0.8629	0.0108		0.1363	0.1363		0.1363	0.1363	0.0000	8,361.6027	8,361.6027	0.3320	0.0968	8,398.5685
Mobile	16.4765	53.2482	201.9314	0.6273	41.8145	0.8670	42.6815	11.2007	0.7995	12.0002	0.0000	57,161.4259	57,161.4259	1.6347	0.0000	57,195.7553
Waste						0.0000	0.0000		0.0000	0.0000	1,606.5649	0.0000	1,606.5649	94.9453	0.0000	3,600.4154
Water						0.0000	0.0000		0.0000	0.0000	58.9253	1,384.1204	1,443.0456	6.1147	0.1558	1,619.7650
Total	**34.0383**	**55.1431**	**219.1252**	**0.6389**	**41.8145**	**1.1168**	**42.9313**	**11.2007**	**1.0491**	**12.2498**	**1,665.4901**	**67,273.9249**	**68,939.4150**	**103.0593**	**0.2588**	**71,183.8980**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**49.10**	**0.00**	**2.28**	**47.95**	**0.09**	**4.81**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	2,836.8060
Vegetation Land Change	-4,114.3010
Total	**-1,277.4950**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	2/24/2016	5	1	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	0.5883	6.3114	4.7076	5.2100e-003		0.3198	0.3198		0.2983	0.2983	0.0000	488.6086	488.6086	0.1325	0.0000	491.3901
Total	**0.5883**	**6.3114**	**4.7076**	**5.2100e-003**		**0.3198**	**0.3198**		**0.2983**	**0.2983**	**0.0000**	**488.6086**	**488.6086**	**0.1325**	**0.0000**	**491.3901**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.4900e-003	0.0138	0.1439	2.7000e-004	0.0215	2.2000e-004	0.0217	5.7000e-003	2.0000e-004	5.9000e-003	0.0000	21.6540	21.6540	1.2900e-003	0.0000	21.6810
Total	**9.4900e-003**	**0.0138**	**0.1439**	**2.7000e-004**	**0.0215**	**2.2000e-004**	**0.0217**	**5.7000e-003**	**2.0000e-004**	**5.9000e-003**	**0.0000**	**21.6540**	**21.6540**	**1.2900e-003**	**0.0000**	**21.6810**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.5883	6.3114	4.7076	5.2100e-003		0.3198	0.3198		0.2983	0.2983	0.0000	488.6080	488.6080	0.1325	0.0000	491.3895
Total	**0.5883**	**6.3114**	**4.7076**	**5.2100e-003**		**0.3198**	**0.3198**		**0.2983**	**0.2983**	**0.0000**	**488.6080**	**488.6080**	**0.1325**	**0.0000**	**491.3895**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.4900e-003	0.0138	0.1439	2.7000e-004	0.0215	2.2000e-004	0.0217	5.7000e-003	2.0000e-004	5.9000e-003	0.0000	21.6540	21.6540	1.2900e-003	0.0000	21.6810
Total	**9.4900e-003**	**0.0138**	**0.1439**	**2.7000e-004**	**0.0215**	**2.2000e-004**	**0.0217**	**5.7000e-003**	**2.0000e-004**	**5.9000e-003**	**0.0000**	**21.6540**	**21.6540**	**1.2900e-003**	**0.0000**	**21.6810**

3.2 Demolition - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0836	0.8903	0.6831	7.8000e-004		0.0447	0.0447		0.0417	0.0417	0.0000	72.3399	72.3399	0.0197	0.0000	72.7530
Total	**0.0836**	**0.8903**	**0.6831**	**7.8000e-004**		**0.0447**	**0.0447**		**0.0417**	**0.0417**	**0.0000**	**72.3399**	**72.3399**	**0.0197**	**0.0000**	**72.7530**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2800e-003	1.8700e-003	0.0195	4.0000e-005	3.2100e-003	3.0000e-005	3.2400e-003	8.5000e-004	3.0000e-005	8.8000e-004	0.0000	3.1276	3.1276	1.8000e-004	0.0000	3.1314
Total	**1.2800e-003**	**1.8700e-003**	**0.0195**	**4.0000e-005**	**3.2100e-003**	**3.0000e-005**	**3.2400e-003**	**8.5000e-004**	**3.0000e-005**	**8.8000e-004**	**0.0000**	**3.1276**	**3.1276**	**1.8000e-004**	**0.0000**	**3.1314**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0836	0.8903	0.6831	7.8000e-004		0.0447	0.0447		0.0417	0.0417	0.0000	72.3398	72.3398	0.0197	0.0000	72.7529
Total	**0.0836**	**0.8903**	**0.6831**	**7.8000e-004**		**0.0447**	**0.0447**		**0.0417**	**0.0417**	**0.0000**	**72.3398**	**72.3398**	**0.0197**	**0.0000**	**72.7529**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2800e-003	1.8700e-003	0.0195	4.0000e-005	3.2100e-003	3.0000e-005	3.2400e-003	8.5000e-004	3.0000e-005	8.8000e-004	0.0000	3.1276	3.1276	1.8000e-004	0.0000	3.1314
Total	**1.2800e-003**	**1.8700e-003**	**0.0195**	**4.0000e-005**	**3.2100e-003**	**3.0000e-005**	**3.2400e-003**	**8.5000e-004**	**3.0000e-005**	**8.8000e-004**	**0.0000**	**3.1276**	**3.1276**	**1.8000e-004**	**0.0000**	**3.1314**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	16.4765	53.2482	201.9314	0.6273	41.8145	0.8670	42.6815	11.2007	0.7995	12.0002	0.0000	57,161.4259	57,161.4259	1.6347	0.0000	57,195.7553
Unmitigated	16.4765	53.2482	201.9314	0.6273	41.8145	0.8670	42.6815	11.2007	0.7995	12.0002	0.0000	57,161.4259	57,161.4259	1.6347	0.0000	57,195.7553

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
City Park	10.98	10.98	10.98	40,432	40,432
Condo/Townhouse	5,243.00	5,698.00	4830.00	19,947,040	19,947,040
Condo/Townhouse High Rise	4,007.15	4,354.90	3691.50	15,245,238	15,245,238
Elementary School	847.50	0.00	0.00	2,229,942	2,229,942
General Office Building	4,402.20	948.30	391.50	12,288,125	12,288,125
Health Club	5.68	3.60	4.60	19,247	19,247
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	13,266.40	15,436.40	7798.00	47,133,422	47,133,422
Single Family Housing	2,539.11	2,674.71	2328.93	9,608,536	9,608,536
Strip Mall	1,117.35	1,059.90	515.10	3,768,799	3,768,799

Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	31,439.36	30,186.79	19,570.61	110,280,782	110,280,782

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
City Park	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Condo/Townhouse High Rise	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Elementary School	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
General Office Building	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Health Club	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	100	0	0
Regional Shopping Center	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Single Family Housing	10.44	0.00	0.00	100.00	0.00	0.00	100	0	0
Strip Mall	10.12	0.00	0.00	100.00	0.00	0.00	100	0	0
Unenclosed Parking with	0.00	0.00	0.00	0.00	0.00	0.00	100	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.530094	0.057664	0.178835	0.124843	0.039181	0.006319	0.017052	0.034445	0.002509	0.003148	0.003693	0.000531	0.001685

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: Y

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

NaturalGas Mitigated	0.1973	1.7062	0.8629	0.0108		0.1363	0.1363		0.1363	0.1363	0.0000	1,952.9960	1,952.9960	0.0374	0.0358	1,964.8816
NaturalGas Unmitigated	0.1973	1.7062	0.8629	0.0108		0.1363	0.1363		0.1363	0.1363	0.0000	1,952.9960	1,952.9960	0.0374	0.0358	1,964.8816
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,408.6067	6,408.6067	0.2946	0.0610	6,433.6869
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	6,408.6067	6,408.6067	0.2946	0.0610	6,433.6869

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.06878e+007	0.0576	0.4925	0.2096	3.1400e-003		0.0398	0.0398		0.0398	0.0398	0.0000	570.3400	570.3400	0.0109	0.0105	573.8110
Condo/Townhouse High Rise	8.16851e+006	0.0441	0.3764	0.1602	2.4000e-003		0.0304	0.0304		0.0304	0.0304	0.0000	435.9027	435.9027	8.3500e-003	7.9900e-003	438.5556
Elementary School	739275	3.9900e-003	0.0362	0.0304	2.2000e-004		2.7500e-003	2.7500e-003		2.7500e-003	2.7500e-003	0.0000	39.4505	39.4505	7.6000e-004	7.2000e-004	39.6906
General Office Building	5.4114e+006	0.0292	0.2653	0.2228	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.7729	288.7729	5.5300e-003	5.2900e-003	290.5303
Health Club	49500	2.7000e-004	2.4300e-003	2.0400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.6415	2.6415	5.0000e-005	5.0000e-005	2.6576
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	509600	2.7500e-003	0.0250	0.0210	1.5000e-004		1.9000e-003	1.9000e-003		1.9000e-003	1.9000e-003	0.0000	27.1942	27.1942	5.2000e-004	5.0000e-004	27.3597
Single Family Housing	1.10044e+007	0.0593	0.5071	0.2158	3.2400e-003		0.0410	0.0410		0.0410	0.0410	0.0000	587.2373	587.2373	0.0113	0.0108	590.8111
Strip Mall	27300	1.5000e-004	1.3400e-003	1.1200e-003	1.0000e-005		1.0000e-004	1.0000e-004		1.0000e-004	1.0000e-004	0.0000	1.4568	1.4568	3.0000e-005	3.0000e-005	1.4657
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1974**	**1.7062**	**0.8629**	**0.0108**		**0.1363**	**0.1363**		**0.1363**	**0.1363**	**0.0000**	**1,952.9960**	**1,952.9960**	**0.0374**	**0.0358**	**1,964.8816**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
City Park	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	1.06878e+007	0.0576	0.4925	0.2096	3.1400e-003		0.0398	0.0398		0.0398	0.0398	0.0000	570.3400	570.3400	0.0109	0.0105	573.8110
Condo/Townhouse High Rise	8.16851e+006	0.0441	0.3764	0.1602	2.4000e-003		0.0304	0.0304		0.0304	0.0304	0.0000	435.9027	435.9027	8.3500e-003	7.9900e-003	438.5556
Elementary School	739275	3.9900e-003	0.0362	0.0304	2.2000e-004		2.7500e-003	2.7500e-003		2.7500e-003	2.7500e-003	0.0000	39.4505	39.4505	7.6000e-004	7.2000e-004	39.6906
General Office Building	5.4114e+006	0.0292	0.2653	0.2228	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.7729	288.7729	5.5300e-003	5.2900e-003	290.5303
Health Club	49500	2.7000e-004	2.4300e-003	2.0400e-003	1.0000e-005		1.8000e-004	1.8000e-004		1.8000e-004	1.8000e-004	0.0000	2.6415	2.6415	5.0000e-005	5.0000e-005	2.6576
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	509600	2.7500e-003	0.0250	0.0210	1.5000e-004		1.9000e-003	1.9000e-003		1.9000e-003	1.9000e-003	0.0000	27.1942	27.1942	5.2000e-004	5.0000e-004	27.3597
Single Family Housing	1.10044e+007	0.0593	0.5071	0.2158	3.2400e-003		0.0410	0.0410		0.0410	0.0410	0.0000	587.2373	587.2373	0.0113	0.0108	590.8111
Strip Mall	27300	1.5000e-004	1.3400e-003	1.1200e-003	1.0000e-005		1.0000e-004	1.0000e-004		1.0000e-004	1.0000e-004	0.0000	1.4568	1.4568	3.0000e-005	3.0000e-005	1.4657
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1974**	**1.7062**	**0.8629**	**0.0108**		**0.1363**	**0.1363**		**0.1363**	**0.1363**	**0.0000**	**1,952.9960**	**1,952.9960**	**0.0374**	**0.0358**	**1,964.8816**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			

City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.12485e+006	894.2283	0.0411	8.5000e-003	897.7279
Condo/Townhouse High Rise	2.38828e+006	683.4459	0.0314	6.5000e-003	686.1206
Elementary School	443941	127.0412	5.8400e-003	1.2100e-003	127.5384
General Office Building	6.6294e+006	1,897.1148	0.0872	0.0180	1,904.5392
Health Club	31350	8.9713	4.1000e-004	9.0000e-005	9.0064
Parking Lot	465360	133.1707	6.1200e-003	1.2700e-003	133.6919
Regional Shopping Center	4.4688e+006	1,278.8226	0.0588	0.0122	1,283.8273
Single Family Housing	2.53226e+006	724.6496	0.0333	6.8900e-003	727.4855
Strip Mall	239400	68.5084	3.1500e-003	6.5000e-004	68.7765
Unenclosed Parking with	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,408.6067**	**0.2946**	**0.0610**	**6,433.6869**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
City Park	0	0.0000	0.0000	0.0000	0.0000
Condo/Townhouse	3.12485e+006	894.2283	0.0411	8.5000e-003	897.7279
Condo/Townhouse High Rise	2.38828e+006	683.4459	0.0314	6.5000e-003	686.1206
Elementary School	443941	127.0412	5.8400e-003	1.2100e-003	127.5384
General Office Building	6.6294e+006	1,897.1148	0.0872	0.0180	1,904.5392

Health Club	31350	8.9713	4.1000e-004	9.0000e-005	9.0064
Parking Lot	465360	133.1707	6.1200e-003	1.2700e-003	133.6919
Regional Shopping Center	4.4688e+006	1,278.8226	0.0588	0.0122	1,283.8273
Single Family Housing	2.53226e+006	724.6496	0.0333	6.8900e-003	727.4855
Strip Mall	239400	68.5084	3.1500e-003	6.5000e-004	68.7765
Unenclosed Parking with Elevator	2.07101e+006	592.6539	0.0272	5.6400e-003	594.9733
Total		**6,408.6067**	**0.2946**	**0.0610**	**6,433.6869**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	17.3645	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938
Unmitigated	17.3645	0.1888	16.3308	8.6000e-004		0.1135	0.1135		0.1132	0.1132	0.0000	366.7760	366.7760	0.0326	6.2400e-003	369.3938

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					

Architectural Coating	2.7244					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0344	0.0000	1.8700e-003	0.0000		0.0238	0.0238		0.0235	0.0235	0.0000	340.1783	340.1783	6.5200e-003	6.2400e-003	342.2485
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.3645**	**0.1888**	**16.3308**	**8.6000e-004**		**0.1135**	**0.1135**		**0.1132**	**0.1132**	**0.0000**	**366.7760**	**366.7760**	**0.0326**	**6.2400e-003**	**369.3938**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.7244					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1057					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0344	0.0000	1.8700e-003	0.0000		0.0238	0.0238		0.0235	0.0235	0.0000	340.1783	340.1783	6.5200e-003	6.2400e-003	342.2485
Landscaping	0.5000	0.1888	16.3289	8.6000e-004		0.0897	0.0897		0.0897	0.0897	0.0000	26.5977	26.5977	0.0261	0.0000	27.1453
Total	**17.3645**	**0.1888**	**16.3308**	**8.6000e-004**		**0.1135**	**0.1135**		**0.1132**	**0.1132**	**0.0000**	**366.7760**	**366.7760**	**0.0326**	**6.2400e-003**	**369.3938**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			

Unmitigated	1,443.0456	6.1158	0.1561	1,619.8590
Mitigated	1,443.0456	6.1147	0.1558	1,619.7650

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 30.9311	98.3397	4.5200e-003	9.4000e-004	98.7245
Condo/Townhouse	24.1556 / 41.2391	228.7835	0.7973	0.0207	251.9396
Condo/Townhouse High Rise	18.4618 / 31.5184	174.8560	0.6094	0.0158	192.5539
Elementary School	0.962976 / 6.70565	25.2131	0.0325	9.8000e-004	26.1992
General Office Building	40.9485 / 67.9642	381.6520	1.3513	0.0350	420.8821
Health Club	77.935 / 0.129977	315.5381	2.5529	0.0627	388.5946
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	10.9848 / 18.2321	102.3820	0.3625	9.3900e-003	112.9058
Single Family Housing	11.6982 / 19.9715	110.7966	0.3861	0.0100	122.0108
Strip Mall	0.588473 / 0.976719	5.4848	0.0194	5.0000e-004	6.0485
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,443.0457**	**6.1158**	**0.1561**	**1,619.8590**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
City Park	0 / 30.9311	98.3397	4.5200e-003	9.4000e-004	98.7245
Condo/Townhouse	24.1556 / 41.2391	228.7835	0.7971	0.0207	251.9274
Condo/Townhouse High Rise	18.4618 / 31.5184	174.8560	0.6092	0.0158	192.5445
Elementary School	0.962976 / 6.70565	25.2131	0.0325	9.8000e-004	26.1987
General Office Building	40.9485 / 67.9642	381.6520	1.3510	0.0350	420.8613
Health Club	77.935 / 0.129977	315.5381	2.5524	0.0626	388.5552
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	10.9848 / 18.2321	102.3820	0.3624	9.3800e-003	112.9003
Single Family Housing	11.6982 / 19.9715	110.7966	0.3860	0.0100	122.0049
Strip Mall	0.588473 / 0.976719	5.4848	0.0194	5.0000e-004	6.0482
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1,443.0457**	**6.1147**	**0.1558**	**1,619.7650**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	1,606.5649	94.9453	0.0000	3,600.4154
Unmitigated	3,213.1297	189.8905	0.0000	7,200.8308

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	59.13	12.0029	0.7094	0.0000	26.8992
Condo/Townhouse	3262.22	662.2012	39.1350	0.0000	1,484.0355
Condo/Townhouse High Rise	2492.44	505.9428	29.9004	0.0000	1,133.8504
Elementary School	230.26	46.7407	2.7623	0.0000	104.7489
General Office Building	4885.92	991.7976	58.6136	0.0000	2,222.6824
Health Club	3.94	0.7998	0.0473	0.0000	1.7924
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3145.72	638.5527	37.7374	0.0000	1,431.0378
Single Family Housing	1579.79	320.6831	18.9518	0.0000	718.6715
Strip Mall	169.51	34.4090	2.0335	0.0000	77.1128
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000

Total		**3,213.1298**	**189.8905**	**0.0000**	**7,200.8308**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
City Park	29.565	6.0014	0.3547	0.0000	13.4496
Condo/Townhouse	1631.11	331.1006	19.5675	0.0000	742.0178
Condo/Townhouse High Rise	1246.22	252.9714	14.9502	0.0000	566.9252
Elementary School	115.13	23.3704	1.3812	0.0000	52.3745
General Office Building	2442.96	495.8988	29.3068	0.0000	1,111.3412
Health Club	1.97	0.3999	0.0236	0.0000	0.8962
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1572.86	319.2764	18.8687	0.0000	715.5189
Single Family Housing	789.895	160.3416	9.4759	0.0000	359.3357
Strip Mall	84.755	17.2045	1.0168	0.0000	38.5564
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**1,606.5649**	**94.9453**	**0.0000**	**3,600.4154**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
	0	0.00	0			Diesel

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	-1,277.4950	0.0000	0.0000	-1,277.4950

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Cropland	7.4 / 0	-45.8800	0.0000	0.0000	-45.8800
Grassland	39.1 / 0	-168.5210	0.0000	0.0000	-168.5210
Others	107.5 / 0	0.0000	0.0000	0.0000	0.0000
Scrub	244 / 0	-3,489.2000	0.0000	0.0000	-3,489.2000
Trees	3.7 / 0	-410.7000	0.0000	0.0000	-410.7000
Wetlands	17.1 / 0	0.0000	0.0000	0.0000	0.0000
Total		**-4,114.3010**	**0.0000**	**0.0000**	**-4,114.3010**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Miscellaneous	3911	2,768.9880	0.0000	0.0000	2,768.9880
True Fir/Hemlock	89	67.8180	0.0000	0.0000	67.8180
Total		**2,836.8060**	**0.0000**	**0.0000**	**2,836.8060**

Appendix C

Water Demand Projections for Entrada South Village

Technical Memorandum

To: Alex Herrell – Newhall Land & Farming Co.

From: John Porcello – GSI Water Solutions, Inc.
Adrienne Lindsey – GSI Water Solutions, Inc.

Date: May 16, 2014

Re: Water Demand Projections for Entrada Village South

Introduction

This technical memorandum presents an update to water demand projections for the southern portion of the Entrada Village (herein referred to as Entrada Village South). Water demand projections have been prepared in the past for Entrada Village to support (1) water system planning activities by Valencia Water Company (VWC), which will provide water service to Entrada Village, and (2) the development of Environmental Impact Review (EIR) documents being prepared by the Newhall Land & Farming Company (NLF). Details regarding prior water demand projections for Entrada Village are provided by GSI (2010). Further updates to these projections were made in 2013 and 2014 for Entrada Village South, based on land use plans that were updated in 2013 for this particular 382-acre portion of the Entrada Village community. The water demand projections for Entrada Village South are the subject of this technical memorandum, followed by a discussion of the Best Management Practices (BMPs) for water conservation that NLF will implement into the design of the new buildings, landscaping, and other infrastructure that will be constructed as Entrada Village South is developed.

Water Demand Projection Methodology

Water demand projections for Entrada Village South were developed using the same methodology described in previous analyses for all of Entrada Village (GSI, 2010) and for the adjoining Newhall Ranch planned community (CH2M HILL, 1996 and 1999; GSI, 2008). This methodology is based on a water demand projection methodology developed by the Irvine Ranch Water District (IRWD, 1991).

Like the adjoining planned community of Newhall Ranch, Entrada Village is being designed with the goal of creating a water reuse system that will recycle (after treatment) virtually all the wastewater generated by the community. Under this approach, discharges to the Santa Clara River from water reclamation plants that treat wastewater generated inside Entrada Village will not occur or will be minor in volume and will occur only seasonally. The water demand projection tool categorizes a community's water demands as indoor (potable) demands, outdoor potable demands, and outdoor demands that can be met with nonpotable water. The tool defines the available supply of recycled water as being equal to the indoor potable water use. The tool also compares the nonpotable water demands with the available recycled water supply and, on a month-by-month basis, identifies how this supply can be used during various months as follows:

1. During the lowest-demand months, the amount of recycled water that either must be discharged to the Santa Clara River or is available as recycled water supply for other developments in the Santa Clarita Valley; and

2. During all other months, the amount of nonpotable demand that must be met by other water supplies.

As described by GSI (2008 and 2010), water demand projections are calculated using the following information:

1. **Land Use.** The current land use plan for Entrada Village South is directly specified in the water demand calculations, using information from Vesting Tentative Tract Maps (VTTMs) that have been submitted to Los Angeles County. Table 1 presents the land use information for Entrada Village South, including the details of the VTTM planning areas and product types that correspond to each land use category that is used in the water demand calculation tool. Table 2 presents this same information in the format that is used directly in the water demand calculation tool. The land use information shown collectively in these two tables consists of the acreage of each land use category, the number of attached and detached residential dwelling units, the occupancy rates and corresponding residential population, and the square footage of certain non-residential facilities.

2. **Residential Use of Potable Water.** For residential areas, the water demand calculations use the same rates of indoor and outdoor potable water consumption that were used in the prior water demand analysis for the entire Entrada Village (GSI, 2010).

    - **Indoor Use.** For residential areas, the water demand projection tool uses a per-capita potable water use rate of 75 gallons per capita per day (gpcpd) for attached residences and for the highest-density single-family residences. Mixed-use residences are assigned a rate of 70 gpcpd. Lower-density single-family residences are assigned rates ranging from 80 gpcpd to as much as 100 gpcpd (for estates).

    - **Outdoor Use.** Potable water will be the source of supply for outdoor residential water uses that occur outside of common areas, such as on single-family lots.

Potable water also will be used for certain outdoor needs in multi-family residential communities, such as filling swimming pools and washing cars, pavement, and outdoor surfaces. The water demand projection tool uses outdoor potable water use rates of 42 to 45 gpcpd for high-density and medium-density residential developments, and 50 to 60 gpcpd for low-density single-family housing (including estates).

3. **Nonresidential Use of Potable Water.** As described by GSI (2010), these water use rates are as follows:

    - **Indoor Use.** Indoor use rates for potable water range from 0.01 to 0.20 gallon per day per square foot for facilities with high occupancy during portions of the day, such as retail commercial facilities, business parks, and hotels. Hospitals and senior assisted living facilities are assigned indoor water use rates that reflect the multi-day occupancy of the residents in these facilities (500 and 100 gallons per day per bed, respectively). Schools are assigned an indoor potable use rate of 260 gallons per acre per day.

    - **Outdoor Use.** Potable water will be used outdoors for nonresidential uses that have the potential for human contact with the water (primarily swimming pools, wash water, and some landscape irrigation). The outdoor potable use rate is specified as 305 gallons per acre per day for industrial facilities, fire stations, hotels, and visitor-serving facilities (including the club houses at golf courses). Hospitals and senior assisted living facilities are assigned outdoor potable water use rates of 120 gallons per day per bed.

4. **Nonpotable Water Use.** The water demand calculations use revised rates of annual nonpotable water use, as determined by VWC and Dexter Wilson Engineering, Inc. (DWE), during a 2007 update of the recycled water master plan for VWC's service area (DWE, 2007). In Entrada Village and other nearby planned communities, nonpotable water will be used for irrigation of common-area landscaping. Common-area landscaping will be present in areas containing attached residential developments, nonresidential developments, recreational facilities, and irrigated slopes.[1] In order to provide conservative (high) projections of water use for planning purposes, the water demand calculations assume the following rates of nonpotable water use:

    - 6.7 feet per year (ft/yr) (equivalent to about 80 inches per year [in/yr]) for attached residential development, assuming 15 percent of the area containing these developments will be irrigated

    - 1.34 to 1.40 ft/yr (16 to 17 in/yr) for nonresidential development, assuming 25 percent of the area containing nonresidential development will be irrigated

[1] For lands that are designated as non-irrigated slopes, irrigation may occur temporarily to establish plantings on these slopes. Because this would occur during the early stages of development before Entrada Village South is fully built out, this use of water would not result in exceedance of the total projected water demand for Entrada Village South that is presented in this technical memorandum.

- 4.59 ft/yr (55 in/yr) for golf courses and water features
- 3.43 ft/yr (41 in/yr) for other recreational facilities and for parks
- 3.47 ft/yr (42 in/yr) for landscaping located on irrigated slopes and along arterial highways and easements

Results

Figure 1 shows the relationship among water demands, water supplies, wastewater generation, and recycled water use inside Entrada Village South under the land use plan that is specified in the most current (2013) VTTM for this 382-acre portion of the Entrada Village. The complete suite of calculations is contained in Attachment 1. The principal finding from the calculations is that total water demand in Entrada Village South is projected to be 1,143 acre-feet per year (AF/yr). Specific aspects of this water demand and the generation and use of recycled water inside Entrada Village South are as follows:

1. Potable water demand is projected to be 703 AF/yr.
2. Nonpotable water demand is projected to be 440 AF/yr.
3. The total demand in residential areas within Entrada Village South is projected to be 659 AF/yr. The residential areas collectively are projected to use 607 AF/yr of potable water (of which 379 AF/yr is for indoor use and 228 AF/yr is for outdoor use) and 52 AF/yr of nonpotable water (for additional outdoor uses).
4. The amount of wastewater generated by Entrada Village South is predicted to be 475 AF/yr, which is 67 percent of total potable water use and 100 percent of the indoor use of potable water. Of this 475 AF/yr of generated wastewater, 80 percent (379 AF/yr) is from residences, with the remaining 20 percent (96 AF/yr) being generated by nonresidential development. The annual wastewater volume of 475 AF/yr is equivalent to 0.424 million gallons per day (mgd).
5. Of the 475 AF/yr that flows to WRPs, 80 percent (378 AF/yr) is recycled for irrigation use within Entrada Village South, and the remaining 20 percent (97 AF/yr) is discharged to the Santa Clara River during winter (primarily from December through March) or available as recycled water supply for other areas during those months.

BMPs for Water Conservation

NLF will implement BMPs related to water-use efficiency into the design of new buildings, landscaping, and other infrastructure that will be constructed as Entrada Village South is developed. The water demand factors that are used in the water demand analysis are based on assessments in 2007 and earlier, and accordingly do not account for the reductions in per-capita and acreage-based rates of water use that will be achieved inside Entrada Village South under existing state and county water-use efficiency requirements and under measures being enacted inside VWC's service area. Following are summaries of state rules and local ordinances, and a description of water conservation and water use reduction activities and programs by VWC and other local water purveyors.

State Rules and Local Ordinances

A series of four laws were enacted by the state legislature from 2006 through 2009 to promote efforts to reduce water use state-wide in response to drought conditions and increasing population. These laws were accompanied by the passage of ordinances by state and local regulatory agencies to implement the legislation. Table 3 lists these laws and ordinances and identifies the entities and types of development activities to which they apply.

While three of the laws targeted specific uses, the fourth law (Senate Bill SBX7-7) is a much broader legislation that addresses urban water use on a state-wide scale. SBX7-7 requires the state to achieve a 20 percent reduction in urban per-capita water use by the end of 2020. In the Santa Clarita Valley, this is implemented in part by requiring the local water purveyors to establish in their Urban Water Management Plan demand-reduction targets and associated implementation programs involving Best Management Practices (BMPs) or Demand Management Measures (DMMs). Other implementation mechanisms that pertain to water-use reductions statewide and locally are the state's CALGreen building standards, a state model ordinance for water efficient landscaping, and two Los Angeles County (L.A. County) ordinances, each of which are discussed below.

California's Green Building Standards

CALGreen is the state's green buildings standards code. It is formally known as Title 24, Part 11, the California Green Building Standards Code. CALGreen identifies mandatory and voluntary provisions that apply to the planning, design, operation, construction, use, and occupancy of every newly constructed building or structure on a statewide basis. Certain provisions that are under the jurisdiction of the California Department of Housing and Community Development (HCD) apply to "low-rise residential" facilities, which are defined by CALGreen as "A building that is of Occupancy Group R and is three stories or less, or that is a one- or two-family dwelling or townhouse." (See HCD, 2010.) CALGreen also requires that each portion of a mixed occupancy building comply with the specific green building measures applicable to that occupancy. Therefore, if a building's design includes commercial and residential uses, both non-residential and residential provisions apply to appropriate portions of the building.

CALGreen was published in mid-2010 as part of the 2010 code adoption process and became effective on January 1, 2011. CALGreen is updated every 3 years. The 2013 California Building Standards Code, which includes the 2013 version of CALGreen, was published by the California Building Standards Commission on July 1, 2013 and becomes effective on January 1, 2014. This update includes changes to certain mandatory measures for residences, including for indoor and outdoor water uses. Table 4 summarizes the assemblage of water use standards that will be in effect on January 1, 2014.

California's Model Water Efficient Landscape Ordinance

In 2006, the California Assembly passed legislation (Assembly Bill [AB] 1881) which is known as the *Water Conservation in Landscaping Act of 2006*. AB 1881 requires cities and counties to develop and implement (1) guidelines for local landscape ordinances and water efficient landscape design, and (2) regulations and performance standards for energy efficient landscape materials (including controllers and soil moisture sensors). This legislation also required that water purveyors, after January 1, 2005, install separate water meters to measure the volume of water used exclusively for landscape purposes.

On September 10, 2010, the California Department of Water Resources (DWR) adopted its Model Water Efficient Landscape Ordinance (MWELO) in response to passage of AB 1881. Local agencies subsequently were required to adopt this ordinance or an alternative local ordinance by January 2010. At that time, the City of Santa Clarita notified DWR that it would adopt the state's MWELO, rather than develop its own ordinance (DWR, 2010). According to a recent report to the state legislature (DWR, 2010), L.A. County did not provide notification, most likely because it had already enacted ordinances in 2009 that specify water use efficiency requirements for landscapes and indoor water uses, as discussed below.

L.A. County Ordinances

On December 18, 2008, two L.A. County ordinances became effective that amend Title 21 (Subdivisions) and Title 22 (Planning and Zoning) of the Los Angeles County Code to:

- Establish drought-tolerant landscaping requirements for projects constructed after January 1, 2009 (ordinance number 2008-0064), and

- Establish green building development standards for projects constructed after January 1, 2009 (ordinance number 2008-0065)

The drought-tolerant landscaping ordinance requires that 75 percent of a lot or parcel's landscaped area contain native and/or non-native plants listed by the county as being drought-tolerant. The ordinance also specifies that no more than 25 percent of the total landscaped area on a lot or parcel can consist of turf. The county's list of drought-tolerant plants and turf is organized by ecological zones, as described in the county's drought-tolerant landscaping handbook (L.A. County, 2012). The Santa Clarita Valley is identified in the handbook as residing in *Zone 6 Inland Mountains (Grapevine, Castaic, Santa Clarita).* For this zone and other zones in L.A. County, the handbook identifies the specific trees, vines, perennials, ground covers, hedges, decorative grasses, and turfs that meet the drought-tolerant landscaping

requirement. The ordinance applies to residential and non-residential properties, but provides exemptions for public recreational lawns, parks, orchards, and vegetable gardens. The ordinance also states that exemptions may be granted by the L.A. County Department of Public Works for landscaped areas constructed as part of stormwater low impact development facilities, and for manufactured cut or fill slopes that have gradients equal to or exceeding a slope of 3:1.

L.A. County's green building development standards specify the following regarding water conservation:

- **Outdoor Water Uses**: A smart irrigation controller shall be installed for any area of a lot that is landscaped for designated for future landscaping, and planting shall meet the requirements of the county's drought-tolerant ordinance.

- **Indoor Water Conservation**: All tank-type toilets installed in residential projects containing five or more dwelling units regardless of gross floor area, or in hotels/motels, lodging houses, non-residential, and mixed-use buildings with a gross floor area of at least 10,000 square feet shall be high-efficiency toilets that use no more than 1.28 gallons per flush.

Conservation and Water-Use-Reduction Activities by Valencia Water Company

VWC and the other water purveyors in the Santa Clarita Valley have long recognized the need to encourage their customers to use water wisely. Educational programs and customer incentives to reduce water have been in place for many years. VWC has employed a full-time water conservation coordinator since 2005, and has added two more conservation specialists since that time. VWC also utilizes consultant services to implement various programs, including water audits, landscape training, and public outreach. A list of key activities by VWC is contained in Table 5.

In 2006, VWC became a signatory to the California Urban Water Conservation Council (CUWCC) MOU, establishing a firm commitment to the implementation of BMPs or DMMs (demand management measures). In 2007, VWC coordinated the development and execution of an MOU with the other retail water purveyors to develop the Santa Clarita Valley Water Use Efficiency Strategic Plan (SCVWUESP [A&N Technical Services, 2008]). The SCVWUESP provided detailed information on available water use efficiency opportunities and defined concepts for program implementation, including a mix of recommended programs, a stakeholder engagement process, and funding mechanisms. While the plan focused on reducing existing demands, the plan also identified building ordinances as an essential tool for further increasing water use efficiency in new construction. The SCVWUESP developed a comprehensive list of new building standards beyond those contained in local ordinances at that time. Those standards identified design improvements in the water-use efficiency of plumbing fixtures that were estimated to capture 60 percent of the expected reduction in water demand envisions under the SCVWUESP. Several of the changes identified in the SWCWUESP are now captured by recent ordinances – in particular, the state's MWELO for landscaping (effective January 2010), the CALGreen Building Code (effective January 2011 and updated effective January 2014), and L.A. County's related ordinances (effective January 2009). VWC and the other purveyors in the

Santa Clarita Valley were implementing the majority of the SCVWUESP programs by 2009, including managing and financing the SCVWUESP programs.

As discussed in the local water purveyors' 2010 Urban Water Management Plan (KJC and others, 2011), VWC continues to expand its conservation programs and efforts in order to meet both its SBX7-7 and DMM requirements. On February 1, 2011 VWC changed its single volumetric billing rate structure to a tiered structure to support its WaterSMART Allocation program, which sets customer-specific allocations for all individually metered residential customers. The new rate structure has 5 tiers, with the highest-use tier having billing rates (per 100 cubic feet) that are about 2.5 times higher than the rate for the lowest-use tier. As part of this program VWC maintains an active website that provides its customers with information on conservation measures, links to other resources, and full details about its WaterSMART program. VWC is also committed to expanding recycled water usage in its service area, to offset potable water use for landscape irrigation.

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Table 1
2013 Land Use Details for Entrada Village South

Land Use Category	VTTM Planning Area	No. Of Units	Square Footage	Acreage	Product Type	Notes	Number of Dwellings					Acreage				
Residential							SFD	Detached Condos	Total Detached	Attached	Total DU's	SFD	Detached Condos	Total Detached	Attached	Total DU's
Low Medium (1.1 - 12.0 DU/ac)	SFD: PA-4, PA-5, PA-6, PA-7	517	---	74.4	SFD: PA-4 SFD Detached Condo - 178 DU / 22.3 ac PA-5 SFD 5,250 (50'x105') - 134 DU / 16.5 ac PA-6 SFD 6,050 (55'x110') - 115 DU / 19.4 ac PA-7 SFD 4,500 (45'x100') - 90 DU / 10.0 ac		339	178	517	0	517	52.4	22.0	74.4	0	74.4
Medium (12.1 - 30 DU/ac)	SFA: PA-9, PA-10,PA-11, PA-12, PA-13	1,057	---	51.3	SFA: PA-9 SFA Attached Condo - 255 DU / 11.1 ac PA-10 SFA Attached Condo - 280 DU / 7.7 ac PA-11 SFA Attached Condo - 208 DU / 10.3 ac PA-12 SFA Attached Condo - 120 DU / 10.5 ac PA-13 SFA Attached Condo - 194 DU / 15.6 ac		0	0	0	1,057	1,057	0.0	0.0	0.0	51.3	51.3
High (30+ DU/ac)		0	---	0.0			0	0	0	0	0	0.0	0.0	0.0	0	0.0
Mixed Use		0	---	0.0			0	0	0	0	0	0.0	0.0	0.0	0	0.0
Subtotal		**1,574**		**125.7**			**339**	**178**	**517**	**1,057**	**1,574**	**52.4**	**22.0**	**74.4**	**51.3**	**125.7**
Non-Residential																
Mixed Use		---														
Commercial	PA1-3 and PA-14	---	730,000	45.9	**PA1-3: 680,000 SF Total** Office: 400,000 SF Retail: 280,000 SF **PA-14: 50,000 SF Total** Office: 36,000 SF Retail: 14,000 SF											
Hotel		---	0	0.0	No hotel in Entrada South											
Recreation centers	PA-8	---	0	2.6	* SF not included on VTTM	Estimated at 6,000 sf incuding restrooms & pool storage										
Parks	PA-8	---	0	5.6	* SF not included on VTTM	Estimated at 1,000 sf restroom building										
Fire Station		---	0	0.0	No fire station in Entrada South											
School	PA-8	---	0	9.4	* SF not included on VTTM	Estimated at 75,000 sf										
Subtotal			**730,000**	**63.5**												
Miscellaneous																
Irrigated Slope				54.3	Measured flat; multiply by 1.12 slope factor	60.8 acres using the slope factor										
Wet Zone				2.1												
Roads/bridge				39.4	Includes access roads 3.6 ac and sidewalks 4.5 ac											
Non irrigated slope				0.9	Measured flat, add 1.12 slope factor	1.0 acres using the slope factor										
Debris basin				1.0												
Water quality				2.2												
Nat OS				64.6												
LDZ OS				0.0	Included in Parkways & Medians											
Trail OS				3.8	Concrete trail											
Parkways & medians				20.9	Includes all parkway-landscaped & flat-irrigated areas											
Drainage				3.9	Measured flat, add 1.12 slope factor	4.1 acres using the slope factor										
Subtotal				**193.1**												

	Units	SF **	Acreage
GRAND TOTAL	**1,574**	**730,000**	**382.3**

Abbreviations: SFD = single-family detached, SFA = single-family attached, DU = dwelling unit
VTTM = Vesting Tentative Tract Map
ac = acres, sf = square feet

Prepared by GSI Water Solutions and
the Newhall Land Farming Company

Table 2
2013 Land Use Plan Statistics Used in the Water Demand Calculation Tool
Entrada Village South

Land Use	Has Water Demands?	Area (acres)			No. of Dwelling Units		
		Detached	Attached	Total	Detached	Attached	Total
Residential Development							
Estate	Yes	0.0	0.0	0.0	0	0	0
Low	Yes	0.0	0.0	0.0	0	0	0
Low Medium (Single-Family)	Yes	74.4	0.0	74.4	517	0	517
Medium (Detached Condos)	Yes	0.0	51.3	51.3	0	1,057	1,057
High (Attached Units)	Yes	0.0	0.0	0.0	0	0	0
Mixed Use	Yes	0.0	0.0	0.0	0	0	0
Subtotals		**74.4**	**51.3**	**125.7**	**517**	**1,057**	**1,574**
Nonresidential Development							
Mixed-Use Commercial							
Retail	Yes			0.00			
Office	Yes			27.40			
Commercial	Yes			18.50			
Business Park	Yes			0.0			
Visitor Serving	Yes			0.0			
Water Reclamation Plant	Yes			0.0			
Electrical Substation	No			0.0			
Fire Stations	Yes			0.0			
Hotel/Spa	Yes			0.0			
Sr. Assisted Living	Yes			0.0			
Golf Club House	Yes			0.0			
Schools	Yes						
Elementary (1)	Yes			9.4			
Middle (0)	Yes			0.0			
High (0)	Yes			0.0			
Subtotal				**55.3**			
Recreation, Arterials, Open Space							
Recreation							
Recreation Centers	Yes			2.6			
Neighborhood Parks	Yes			5.6			
Lake - Water	Yes			0.0			
Lake - Park Area	Yes			0.0			
Golf Course	Yes			0.0			
Arterial Highways							
Hardscape/Road Section	No			39.4			
Landscape Area	Yes			20.9			
Major Open Areas							
Natural Open Space	No			64.6			
River Corridor	No			0.0			
Non-Irrigated Slopes	No			0.9			
Irrigated Slopes, Wet Zones	Yes			56.4			
O.S. Drainage Facilities	No			7.1			
O.S. LDZ, O.S. Trail LDZ, and SD&SS easements	Yes			3.8			
Subtotal				**201.3**			
Totals				**382.3**	**517**	**1,057**	**1,574**

Updated May 2014 by GSI Water Solutions, Inc.

Table 3
State and Local Laws, Codes, and Other Requirements for Water-Use Efficiency Enacted Since 2006

Year	Who	Description	What	Applicable To	Compliance Date or Effective Date
2006	California State Assembly	AB 1881	Water Conservation in Landscaping Act of 2006	Local agencies (cities, counties, and/or water purveyors)	1/1/2010 compliance date
2007	California State Assembly	AB 715	Toilets and urinals	New sales and new installations	1/1/2014 effective date
2008	L.A. County	Drought-Tolerant Landscaping Ordinance	Plant selection requirements and turf limits	New construction	1/1/2009 effective date
2008	L.A. County	Green Building Ordinance	Green building standards, including indoor and outdoor water conservation and tree planting requirements (Ordinance 2008-0065)	New construction	1/1/2009 effective date
2009	California State Senate	SB 407	Toilets, urinals, showerheads, and interior faucets	Buildings constructed on or before January 1, 1994	1/1/2017 compliance date for single-family 1/1/2019 compliance date for multi-family residences and commercial properties
2009	California State Senate	SBX7-7	Reductions in Gallons per Capita per Day	Statewide water use	12/31/2020 compliance date
2010	California Department of Water Resources (DWR)	Updated Model Water Efficient Landscape Ordinance (MWELO)	Landscape irrigation (system design, scheduling, and application rates);	Landscapes that require a building or landscape permit	9/10/2010 DWR adoption date
2010	California Building Standards Commission	CALGreen Building Standards Code	Indoor and outdoor water use standards	New construction	1/1/2011 effective date
2013	California Building Standards Commission	Update to CALGreen Building Standards Code	Indoor and outdoor water use standards	New construction	1/1/2014 effective date

Abbreviations
SBX7 = Senate Bill during Extended Session 7 of the 2009 Session SB = Senate Bill AB = Assembly Bill DWR = California Department of Water Resources

Table 4
CALGreen Water Use Standards (Effective January 1, 2014)

Fixture	Standard
Toilets (Water Closets)	≤ 1.28 gal/flush
Urinals	≤ 0.5 gal/flush
Single showerheads	≤ 2.0 gpm @ 80 psi
Multiple showerheads	≤ 2.0 gpm @ 80 psi (per valve)
Lavoratory faucets in residences	≤ 1.5 gpm @ 60 psi
Lavoratory faucets in common areas	≤ 0.5 gpm @ 60 psi
Metering faucets	≤ 0.25 gallons per cycle
Kitchen faucets	≤ 1.8 gpm @ 60 psi
Clothes washers	10 percent below Title 20 standards
Residential dishwashers	≤ 5.8 gallons per cycle and ENERGY STAR certified
Commercial dishwashers	Variable (see Table A5.303.3 in 2010 CALGreen)
Smart irrigation controller	Weather-based or soil-moisture-based

Abbreviations
gal= gallons; gpm = gallons per minute; psi = pounds per square inch

Table 5
Water Conservation Activities by Valencia Water Company Since 2006

Year	Who	Description	What
2006	Valencia Water Co.	CUWCC MOU	Commitment to implement BMPs or DMMs
2008	Valencia Water Co. and other local water purveyors	Local purveyors' collective strategy for increasing water use efficiency	Santa Clarita Valley Water Use Efficiency Strategic Plan
2011	Valencia Water Co.	Revisions to billing rate structure	Switch from volumetric rate structure to tiered rate structure, to support VWC's WaterSMART Allocation program.
2011	Valencia Water Co. and other local water purveyors	2010 UWMP	Established urban water use targets for SBX7-7 (reductions in per-capita water use by the years 2015 and 2020); presented accordant demand estimates every 5 years for the period 2015 through 2050; and presented Demand Management Measures (DMMs) and recycled water usage plans that are designed to meet the SBX7-7 water use reduction targets. Identified landscape irrigation as providing the greatest opportunity to achieve the reductions.

Abbreviations
CUWCC = CaliforniaUrban Water Conservation Council MOU = Memorandum of Understanding
BMPs = Best Management Practices DMMs = Demand Management Measures
UWMP = Urban Water Management Plan

ATTACHMENT 1

WATER DEMAND CALCULATIONS (MAY 2014)

ENTRADA VILLAGE SOUTH

Table A-1
Land Use Plan Statistics
Entrada Village South

Land Use	Has Water Demands?	Area (acres)			Dwelling Units		
		Detached	Attached	Total	Detached	Attached	Total
Residential Development							
Estate	Yes	0.0	0.0	0.0	0	0	0
Low	Yes	0.0	0.0	0.0	0	0	0
Low Medium (Single-Family)	Yes	74.4	0.0	74.4	517	0	517
Medium (Detached Condos)	Yes	0.0	51.3	51.3	0	1,057	1,057
High (Attached Units)	Yes	0.0	0.0	0.0	0	0	0
Mixed Use	Yes	0.0	0.0	0.0	0	0	0
Subtotals		**74.4**	**51.3**	**125.7**	**517**	**1,057**	**1,574**
Nonresidential Development							
Mixed-Use Commercial							
Retail	Yes			0.00	Includes library		
Office	Yes			27.40	Mixed use office		
Commercial	Yes			18.50	Commercial retail		
Business Park	Yes			0.0	Industrial + office that is in the commercial category		
Visitor Serving	Yes			0.0	Visitor center		
Water Reclamation Plant	Yes			0.0	Newhall WRP		
Electrical Substation	No			0.0	Has no water use		
Fire Stations	Yes			0.0	Fire station(s)		
Hotel/Spa	Yes			0.0	Hotel/spa		
Sr. Assisted Living	Yes			0.0	Sr. Assisted Living		
Golf Club House	Yes			0.0	Golf club house		
Schools	Yes						
Elementary (1)	Yes			9.4			
Middle (0)	Yes			0.0			
High (0)	Yes			0.0			
Subtotal				**55.3**			
Recreation, Arterials, Open Space							
Recreation							
Recreation Centers	Yes			2.6	Recreation centers		
Neighborhood Parks	Yes			5.6	Park (community park)		
Lake - Water	Yes			0.0	Water feature		
Lake - Park Area	Yes			0.0	Assume this is in "Lake-Water" category.		
Golf Course	Yes			0.0	Irrigated. Excludes the club house.		
Arterial Highways							
Hardscape/Road Section	No			39.4	Not irrigated.		
Landscape Area	Yes			20.9	Landscape in parkways and medians		
Major Open Areas							
Natural Open Space	No			64.6			
River Corridor	No			0.0			
Non-Irrigated Slopes	No			0.9	Previously "Community Open Area".		
Irrigated Slopes, Wet Zones	Yes			56.4	Previously "Community Slopes".		
O.S. Drainage Facilities	No			7.1	Debris basins, water quality basins, drainage channels		
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	Yes			3.8	Previously "Ungraded Areas and Easements"		
Subtotal				**201.3**			
Totals				**382.3**	**517**	**1,057**	**1,574**

New or changed land use category (compared with 1996 and 1999 water demand analyses)

HAND-INPUT DATA IN RED

Updated May 2014 by GSI Water Solutions, Inc.

Table A-2
Verification of Updated Population and Density
Entrada Village South

RESIDENTIAL LAND USE	Acreage	Dwelling Units		Occupancy p/DU	Population Estimate
		Detached	Attached		
Estate	0	0	0	3.40	0
Low	0	0	0	3.40	0
Low Medium (Single-Family)	74.4	517	0	3.40	1,758
Medium (Detached Condos)	51.3	0	1057	2.60	2,748
High (Attached Units)	0	0	0	2.60	0
Mixed Use	0	0	0	2.60	0
TOTAL	**126**	**517**	**1,057**		**4,506**

Average Occupancy

Population	4,506	**2.86 p/DU**
Total Dwelling Units	1,574	

Updated May 2014 by GSI Water Solutions, Inc.
References the land use statistics input table.

Table B-1
Residential Development Potable Water Demand Factors
Entrada Village South

Land Use	Interior (gpcpd)	Local Exterior (gpcpd)	Persons per Dwelling Unit	POTABLE gpd/DU (Interior + Exterior)
Rural	100	60	3.40	544
Estate	100	60	3.40	544
Low	80	50	3.40	442
Low Medium (Single-Family)	75	45	3.40	408
Medium (Detached Condos)	75	45	2.60	312
High (Attached Units)	75	45	2.60	312
High	75	45	2.60	312
Mixed Use	70	42	2.60	291

Notes: gpcpd = gallons per capita per day.
The persons per dwelling unit for estates land use category reflects an additional 2 persons per dwelling unit to account for second units.

Updated May 2014 by GSI Water Solutions, Inc.

HAND-INPUT -- WATER USE FACTOR
HAND-INPUT -- OTHER DATA
New or changed land use category (compared with 1996 and 1999 water demand analyses)
= Not Used

Table B-2
Nonresidential Development Potable Water Demand Factors
Entrada Village South

Land Use	Interior Use		Interior Use	Exterior Use
	Units	Factor	(gpapd)	(gpapd)
Mixed-Use Commercial (Retail)	gpd/sq. ft.	0.01	100	0
Commercial (Retail)	gpd/sq. ft.	0.20	2,000	0
Commercial Recreation	gpapd	45.00	45	235
Mixed-Use Commercial (Office)	gpd/sq. ft.	0.05	763	0
Business Park (Office)	gpd/sq. ft.	0.05	3,000	0
Business Park (Industrial)	gpd/sq. ft.	0.20	3,050	305
Institutional	gpd/sq. ft.	0.20	3,050	305
Hotel/Spa	gpd/sq. ft.	0.20	6,000	305
Hospital	gpd/bed	500.00	6,000	120
Sr. Assisted Living	gpd/bed	100.00	6,000	120
Golf Club House	gpd/sq. ft.	0.01	3,050	305
Visitor Serving	gpd/sq. ft.	0.01	3,050	305
Water Reclamation Plant	gpapd	200.00	200	0
Electrical Substation	gpapd	0.00	0	0
Fire Stations	gpd/sq. ft.	0.20	3,050	305
Schools	gpd/student	4.00	260	0
Recreation Centers	gpapd	100.00	100	0
Neighborhood Parks	gpapd	100.00	100	0
Lake - Water	gpapd	0	0	0
Lake - Park Area	gpapd	0	0	0
Golf Course	gpapd	0	0	0
Hardscape/Road Section	gpapd	0	0	0
Landscape Area	gpapd	0	0	0
Natural Open Space	gpapd	0	0	0
River Corridor	gpapd	0	0	0
Non-Irrigated Slopes	gpapd	0	0	0
Irrigated Slopes, Wet Zones	gpapd	0	0	0
O.S. Drainage Facilities	gpapd	0	0	0
Undeveloped / Under Construction	gpapd	0	0	0

Notes: gpapd = Gallons per acre per day based on average square footage per acre
DU = dwelling unit

Table B-3
Nonpotable Water Demand Factors
Entrada Village South

Land Use	Percent Irrigable Land (a)	Annual Usage (ac-ft) Per Gross Acreage (b)	Annual Usage (ac-ft) Per Net Acreage
Residential			
Estate	15%	**1.01**	6.7
Low	15%	**1.01**	6.7
Low Medium (Single-Family)	15%	**1.01**	6.7
Medium (Detached Condos)	15%	**1.01**	6.7
High (Attached Units)	15%	**1.01**	6.7
High	15%	**1.01**	6.7
Mixed Use	15%	**1.01**	6.7
Nonresidential			
Mixed-Use Commercial (Retail)	25%	**1.34**	5.36
Commercial (Retail)	25%	**1.34**	5.36
Commercial Recreation	67%	**3.618**	5.4
Mixed-Use Commercial (Office)	25%	**1.34**	5.36
Business Park (Office)	25%	**1.34**	5.36
Business Park (Industrial)	25%	**1.34**	5.36
Institutional	25%	**1.40**	5.6
Hotel/Spa	25%	**1.34**	5.36
Hospital	25%	**1.40**	5.6
Sr. Assisted Living	25%	**1.40**	5.6
Golf Club House	0%	**0.00**	6.0
Visitor Serving	25%	**1.40**	5.6
Water Reclamation Plant	25%	**1.12**	4.48
Electrical Substation	0%	**0.00**	6.0
Fire Stations	25%	**1.40**	5.6
Schools	25%	**1.40**	5.6
Recreation Centers	100%	**3.43**	3.43
Recreation, Arterials, Open Space			
Neighborhood Parks	100%	**3.43**	3.43
Golf Course	100%	**4.59**	4.59
Lake (Water Feature)	100%	**4.59**	4.59
Arterial Highway Hardscape / Road Section	0%	**0.00**	0.00
Arterial Highway Landscaped Areas	100%	**3.47**	3.47
Natural Open Space	0%	**0.00**	0.00
River Corridor	0%	**0.00**	0.00
Non-Irrigated Slopes	0%	**0.00**	0.00
Irrigated Slopes, Wet Zones	100%	**3.47**	3.47
O.S. Drainage Facilities	0%	**0.00**	0.00
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	100%	**3.47**	3.47
Low Irrigated Agriculture	1.000	2.2	2.2
High Irrigated Agriculture	1.000	6.2	6.2

Notes:
(a) City of Irvine, ITAP TAZ Land Use Inventory and IRWD SAMPs.
(b) Water usage is based on the gross lot area.

Table C-1
Summary of Water Demands
Entrada Village South

Land Use	Water Demand (ac-ft/yr) Potable	Nonpotable	Total
Residential Development			
Estate	0	0	0
Low	0	0	0
Low Medium (Single-Family)	237	0	237
Medium (Detached Condos)	370	52	422
High (Attached Units)	0	0	0
Mixed Use	0	0	0
Subtotals	**607**	**52**	**659**
Nonresidential Development			
Mixed-Use Commercial			
Retail (including library)	0	0	0
Office	25	37	62
Commercial (Retail)	66	25	91
Business Park (Office)	0	0	0
Business Park (Industrial)	0	0	0
Visitor Serving	0	0	0
Water Reclamation Plant	0	0	0
Electrical Substation	0	0	0
Fire Stations	0	0	0
Institutional	0	0	0
Hotel/Spa	0	0	0
Hospital	0	0	0
Sr. Assisted Living	0	0	0
Golf Club House	0	0	0
Schools	3	14	17
Subtotals	**94**	**76**	**170**
Recreation, Arterials, Open Space			
Recreation			
Recreation Centers	1	9	10
Neighborhood Parks	1	20	21
Lake - Water	0	0	0
Lake - Park Area	0	0	0
Golf Course	0	0	0
Arterial Highways			0
Hardscape/Road Section	0	0	0
Landscape Area	0	73	73
Major Open Areas			0
Natural Open Space	0	0	0
River Corridor	0	0	0
Non-Irrigated Slopes	0	0	0
Irrigated Slopes, Wet Zones	0	196	196
O.S. Drainage Facilities	0	0	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	0	14	14
Subtotals	**2**	**312**	**314**
Totals	**703**	**440**	**1,143**

Updated May 2014 by GSI Water Solutions, Inc.

New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table C-2 Summary of Potable and Reclaimed Water Demands Entrada Village South			
Land Use	**Potable**	**Reclaimed**	**Total**
Residential Development	607	52	659
Nonresidential Development	94	76	170
Recreation, Arterials, Open Space	2	312	314
Subtotal	**703**	**440**	**1,143**
Reclaimed Water Supply Generated by Indoor Potable Water Use	**475**		

Updated May 2014 by GSI Water Solutions, Inc.

Table C-3
Water Demand Calculations for Residential Development
Entrada Village South

Land Use	Acreage			Dwelling Units		Estimated Water Demand											
						Potable Use						Irrigation Use (Non-Potable)				Total Use	
	Total	Detached	Attached	Detached	Attached	Interior Use gpcpd (a)	Exterior Use gpcpd (b)	Occupancy p/DU (c)	Interior (ac-ft/yr)	Exterior (ac-ft/yr)	**Subtotal (ac-ft/yr)**	Irrigated Area (d)	Acreage Attached Units (Non-Potable Water)	Annual Use Rate (ac-ft/ac)	**Subtotal (ac-ft/yr)**	(ac-ft/yr)	Gallons Per Day Per Dwelling Unit
Estate	0.0	0.0	0.0	0	0	100	60	3.40	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	---
Low	0.0	0.0	0.0	0	0	80	50	3.40	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	---
Low Medium (Single-Family)	74.4	74.4	0.0	517	0	75	45	3.40	**148**	**89**	**237**	15%	0.0	6.7	**0**	**237**	**409**
Medium (Detached Condos)	51.3	0.0	51.3	0	1,057	75	45	2.60	**231**	**139**	**370**	15%	51.3	6.7	**52**	**422**	**356**
High (Attached Units)	0.0	0.0	0.0	0	0	75	45	2.60	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	---
Mixed Use	0.0	0.0	0.0	0	0	70	42	2.60	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	---
Total Water Demands									**379**	**228**	**607**				**52**	**659**	
Per-Capita Use (gallons/person/day)									**75**	**45**	**120**				**11**	**131**	

Notes:
(a) gpcpd : gallons per capita per day.
Interior water uses include drinking, bathing, laundry, sanitation, etc.
(b) gpcpd : gallons per capita per day.
Exterior water uses include landscape irrigation, washing cars, filling swimming pools, etc.
(c) p/DU : persons per dwelling unit. The estates factor includes 2 persons per dwelling unit additional to account for second units.
(d) Irrigated areas include common areas, greenbelt irrigation within residential neighborhoods, etc.
Percentage is based on gross landscape area.

Source of occupancy and potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)
This is calculated and could potentially serve as a calibration target (i.e., adjust various input variables until this number equals a desired value).

Table C-4
Water Demand Calculations for Nonresidential Development
Entrada Village South

Land Use	Acreage (a)	Floor Space (sq. ft.)	Estimated Water Demand: Potable Use: Interior Use (b)	Exterior Use gpapd (c)	Interior (ac-ft/yr)	Exterior (ac-ft/yr)	Subtotal (ac-ft/yr)	Irrigation Use (Non-Potable): Irrigated Area (d)	Annual Use (ac-ft/ac): Per Gross Acreage	Per Net Acreage	Subtotal (ac-ft/yr)	Total: (ac-ft/yr)	Units	No. of Units	Gallons Per Day Per Unit
Mixed-Use Commercial															
Retail (including library)	0.00	0	0.01	0	0	0	**0**	25%	1.34	5.36	**0**	**0**	TSF	0	**0**
Office	27.40	436,000	0.05	0	25	0	**25**	25%	1.34	5.36	**37**	**62**	TSF	436	**127**
Commercial (Retail)	18.50	294,000	0.20	0	66	0	**66**	25%	1.34	5.36	**25**	**91**	TSF	294	**276**
Business Park (Office)	0.00	0	0.05	0	0	0	**0**	25%	1.34	5.36	**0**	**0**	TSF	0	**0**
Business Park (Industrial)	0.00	0	0.20	305	0	0	**0**	25%	1.34	5.36	**0**	**0**	TSF	0	**0**
Visitor Serving	0.00	0	0.01	305	0	0	**0**	25%	1.40	5.60	**0**	**0**	TSF	0	**0**
Water Reclamation Plant	0.00	0	0.20	0	0	0	**0**	25%	1.12	4.48	**0**	**0**	TSF	0	**0**
Electrical Substation	0.00	0	0.00	0	0	0	**0**	0%	0.00	6.00	**0**	**0**	TSF	0	**0**
Fire Stations	0.00	0	0.20	305	0	0	**0**	25%	1.40	5.60	**0**	**0**	TSF	0	**0**
Institutional	0.00	0	0.20	305	0	0	**0**	25%	1.40	5.60	**0**	**0**	TSF	0	**0**
Hotel/Spa	0.00	0	0.20	305	0	0	**0**	25%	1.34	5.36	**0**	**0**	ROOM	100	**0**
Hospital	0.00	0	500	120	0	0	**0**	25%	1.40	5.60	**0**	**0**	TSF	0	**0**
Sr. Assisted Living	0.00	0	100	120	0	0	**0**	25%	1.40	5.60	**0**	**0**	ROOM	0	**0**
Golf Club House	0.00	0	0.01	305	0	0	**0**	0%	0.00	6.00	**0**	**0**	TSF	0	**0**
Schools							**0**								
Elementary (1)	9.40	N/A	260	0	3	0	**3**	25%	1.40	5.60	**14**	**17**	STUDENTS	900	**16.9**
Middle (0)	0.00	N/A	260	0	0	0	**0**	25%	1.40	5.60	**0**	**0**	STUDENTS	0	**0.0**
High (0)	0.00	N/A	260	0	0	0	**0**	25%	1.40	5.60	**0**	**0**	STUDENTS	0	**0.0**
Total Water Demands					**94**	**0**	**94**				**76**	**170**			

Notes:
(a) The acreage used in the calculations is the actual floor area ratio acres as supplied by the Newhall Ranch Company.
(b) Interior water uses include drinking and sanitation.
Units are in gallons per day per square foot for the commercial, business park, visitor serving, water reclamation plant, institutional, hotel/spa, and fire station land uses.
Units are in gallons per day per acre for the water treatment plant, electrical substation, and school land uses.
Units are in gallons per day per bed for the hospital and Sr. Assisted Living land use categories.
(c) Potable water is used for outdoor uses that have potential human contact (e.g., swimming pools, wash water, some landscape irrigation).
gpapd : gallons per acre per day. For hospitals and Sr. Assisted Living, the units are gpapd per bed.
(d) Percentage is based on gross landscape area.
Irrigated areas include common areas and greenbelt irrigation.

Source of potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)
This is calculated and could potentially serve as a calibration target (i.e., adjust various input variables until this number equals a desired value).

Table C-5
Water Demand Calculations for Recreation, Arterial, and Open Space Land Uses
Entrada Village South

Land Use	Acreage	Estimated Water Demand						
		Potable Use		Non-Potable Use (Irrigation Only)				Total
		Potable Use gpapd (a)	Subtotal (ac-ft/yr)	Irrigated Area (b)	Annual Use (ac-ft/ac) Per Gross Acreage	Annual Use (ac-ft/ac) Per Net Acreage	Subtotal (ac-ft/yr)	(ac-ft/yr)
Recreation								
Recreation Centers	2.6	100	**1**	100%	3.43	3.43	**9**	**10**
Neighborhood Parks	5.6	100	**1**	100%	3.43	3.43	**20**	**21**
Lake - Water	0.0	0	**0**	100%	4.59	4.59	**0**	**0**
Lake - Park Area	0.0	0	**0**	100%	4.59	4.59	**0**	**0**
Golf Course	0.0	0	**0**	100%	4.59	4.59	**0**	**0**
Arterial Highways								
Hardscape/Road Section	39.4	0	**0**	0%	0	0	**0**	**0**
Landscape Area	20.9	0	**0**	100%	3.47	3.47	**73**	**73**
Major Open Areas								
Natural Open Space	64.6	0	**0**	0%	0	0	**0**	**0**
River Corridor	0.0	0	**0**	0%	0	0	**0**	**0**
Non-Irrigated Slopes	0.9	0	**0**	0%	0	0	**0**	**0**
Irrigated Slopes, Wet Zones	56.4	0	**0**	100%	3.47	3.47	**196**	**196**
O.S. Drainage Facilities	7.1	0	**0**	0%	0	0	**0**	**0**
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	0	**0**	100%	3.47	3.47	**14**	**14**
Total Water Demands			**2**				**312**	**314**

Notes:
(a) gpapd = gallons per acre per day.
(b) Area is estimated as a percentage of gross area .

Source of potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-1 Summary of Wastewater Generation Entrada Village South	
Land Use	**Wastewater (ac-ft/yr)**
Residential Development	
Estate	0
Low	0
Low Medium (Single-Family)	148
Medium (Detached Condos)	231
High (Attached Units)	0
Mixed Use	0
Subtotal	**379**
Nonresidential Development	
Mixed-Use Commercial	
Retail (including library)	0
Office	25
Commercial (Retail)	66
Business Park (Office)	0
Business Park (Industrial)	0
Visitor Serving	0
Water Reclamation Plant	0
Electrical Substation	0
Fire Stations	0
Institutional	0
Hotel/Spa	0
Hospital	0
Sr. Assisted Living	0
Golf Club House	0
Schools	
Elementary (1)	3
Middle (0)	0
High (0)	0
Subtotal	**94**
Recreation, Arterials, Open Space	
Recreation Centers	1
Neighborhood Parks	1
Lake - Water	0
Lake - Park Area	0
Golf Course	0
Arterial Highways	
Hardscape/Road Section	0
Landscape Area	0
Major Open Areas	
Natural Open Space	0
River Corridor	0
Non-Irrigated Slopes	0
Irrigated Slopes, Wet Zones	0
O.S. Drainage Facilities	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	0
Subtotal	**2**
Total Wastewater Generated	**475**
Wastewater generation is based on IRWD water demand factors.	

Updated May 2014 by GSI Water Solutions, Inc.

New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-2
Wastewater Generation Calculations for Residential Development (a)
Entrada Village South

Land Use	Dwelling Units				Wastewater Generated	
	Total Area (acres)	Detached Units	Attached Units	Occupancy (p/DU) (c)	Ave. Rate (gpcpd) (b)	Total (ac-ft/year)
Estate	.0	0	0	3.40	100	**0**
Low	.0	0	0	3.40	80	**0**
Low Medium (Single-Family)	74.4	517	0	3.40	75	**148**
Medium (Detached Condos)	51.3	0	1,057	2.60	75	**231**
High (Attached Units)	.0	0	0	2.60	75	**0**
Mixed Use	.0	0	0	2.60	70	**0**
Total Wastewater Generated						**379**

Notes:
(a) Wastewater generation is based on IRWD interior water demand factors.
(b) gpcpd : gallons per capita per day.
Interior water uses include drinking, bathing, laundry, sanitation, etc.
(c) p/DU : persons per dwelling unit.

Source of occupancy and potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-3
Wastewater Generation Calculations for Nonresidential Development (a)
Entrada Village South

Land Use	Area		Wastewater Generated	
	Net Acres	Floor Space (sq. ft.)	Ave. Rate (gpd/sq. ft.) (b)	Total (ac-ft/yr)
Mixed-Use Commercial				
Retail (including library)	0.0		0.01	**0**
Office	27.4	436,000	0.05	**25**
Commercial (Retail)	18.5	294,000	0.20	**66**
Business Park (Office)	0.0		0.05	**0**
Business Park (Industrial)	0.0		0.20	**0**
Visitor Serving	0.0		0.01	**0**
Water Reclamation Plant	0.0		0.20	**0**
Electrical Substation	0.0		0.00	**0**
Fire Stations	0.0		0.20	**0**
Institutional	0.0		0.20	**0**
Hotel/Spa	0.0		0.20	**0**
Hospital	0.0		500	**0**
Sr. Assisted Living	0.0		100	**0**
Golf Club House	0.0		0.01	**0**
Schools				
Elementary (1)	9.4	N/A	260	**3**
Middle (0)	0	N/A	260	**0**
High (0)	0	N/A	260	**0**
Total Wastewater Generated				**94**

Notes:
(a) Wastewater generation is based on IRWD interior water demand factors
(b) Interior water uses include drinking and sanitation.
Units are in gallons per day per square foot for the commercial, business park, visitor serving, water reclamation plant, institutional, hotel/spa, and fire station land uses.
Units are in gallons per day per acre for the water treatment plant, electrical substation, and school land uses.
Units are in gallons per day per bed for the hospital and Sr. Assisted Living land use categories.

Source of potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-4
Wastewater Generation Calculations for Recreation, Arterial, and Open-Space Land Uses (a)
Entrada Village South

Land Use	Area	Wastewater Generated	
	Acres	Ave. Rate (gpapd) (b)	Total (ac-ft/yr)
Recreation			
Recreation Centers	2.6	100	1
Neighborhood Parks	5.6	100	1
Lake - Water	0.0	0	0
Lake - Park Area	0.0	0	0
Golf Course	0.0	0	0
Arterial Highways			
Hardscape/Road Section	39.4	0	0
Landscape Area	20.9	0	0
Major Open Areas			
Natural Open Space	64.6	0	0
River Corridor	0.0	0	0
Non-Irrigated Slopes	0.9	0	0
Irrigated Slopes, Wet Zones	56.4	0	0
O.S. Drainage Facilities	7.1	0	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	0	0
Total Wastewater Generated			**2**

Notes:

(a) Wastewater generation is based on IRWD interior water demand factors.

(b) gpapd = gallons per acre per day.

Source of potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.

New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table E-1
Nonpotable Irrigated Acreage
Entrada Village South

		Nonresidential		Recreation, Arterials, Open Space		Total
Land Use	**Acreage**	**Land Use**	**Acreage**	**Land Use**	**Acreage**	
Estate	0.0	Mixed-Use Commercial		Recreation		
Low	0.0	Retail (including library)	0.0	Recreation Centers	2.6	
Low Medium (Single-Family)	0.0	Office	6.9	Neighborhood Parks	5.6	
Medium (Detached Condos)	7.7	Commercial (Retail)	4.6	Lake - Water	0.0	
High (Attached Units)	0.0	Business Park (Office)	0.0	Lake - Park Area	0.0	
Mixed Use	0.0	Business Park (Industrial)	0.0	Golf Course	0.0	
		Visitor Serving	0.0	Arterial Highways		
		Water Reclamation Plant	0.0	Hardscape/Road Section	0.0	
		Electrical Substation	0.0	Landscape Area	20.9	
		Fire Stations	0.0	Major Open Areas		
		Institutional	0.0	Natural Open Space	0.0	
		Hotel/Spa	0.0	River Corridor	0.0	
		Hospital	0.0	Non-Irrigated Slopes	0.0	
		Sr. Assisted Living	0.0	Irrigated Slopes, Wet Zones	56.4	
		Golf Club House	0.0	O.S. Drainage Facilities	0.0	
		Schools		O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	
		Elementary (1)	2.4			
		Middle (0)	0.0			
		High (0)	0.0			
Total Irrigated	**7.7**		**13.8**		**89.3**	**110.8**
Total Acreage	**125.7**		**55.3**		**201.3**	**382.3**
Percent Irrigated	**6%**		**25%**		**44%**	**29%**

Updated May 2014 by GSI Water Solutions, Inc.

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table F-1
Entrada Village South Monthly Operations
Updated May 2014 by GSI Water Solutions, Inc.

Monthly Distribution of Demand From UC Extension

Monthly Demand		(% of Annual)		Potable Demand (Ac-Ft per Month)		Total Demands Ac-Ft per Month		
Month	Days/Mo	Interior	Exterior	Interior	Exterior	Month	Potable Demand	Nonpotable Demand	Total
J	31	8.49%	3.77%	40	9	J	49	17	66
F	28	7.67%	5.09%	36	12	F	48	22	70
M	31	8.49%	6.57%	40	15	M	55	29	84
A	30	8.22%	9.10%	39	21	A	60	40	100
M	31	8.49%	10.56%	40	24	M	64	46	111
J	30	8.22%	11.36%	39	26	J	65	50	115
J	31	8.49%	14.11%	40	32	J	73	62	135
A	31	8.49%	12.93%	40	29	A	70	57	127
S	30	8.22%	10.23%	39	23	S	62	45	107
O	31	8.49%	7.51%	40	17	O	57	33	90
N	30	8.22%	5.01%	39	11	N	50	22	72
D	31	8.49%	3.77%	40	9	D	49	17	66
		100%	100%	475	228		703	440	1,143
			check:	475	228				
					703				

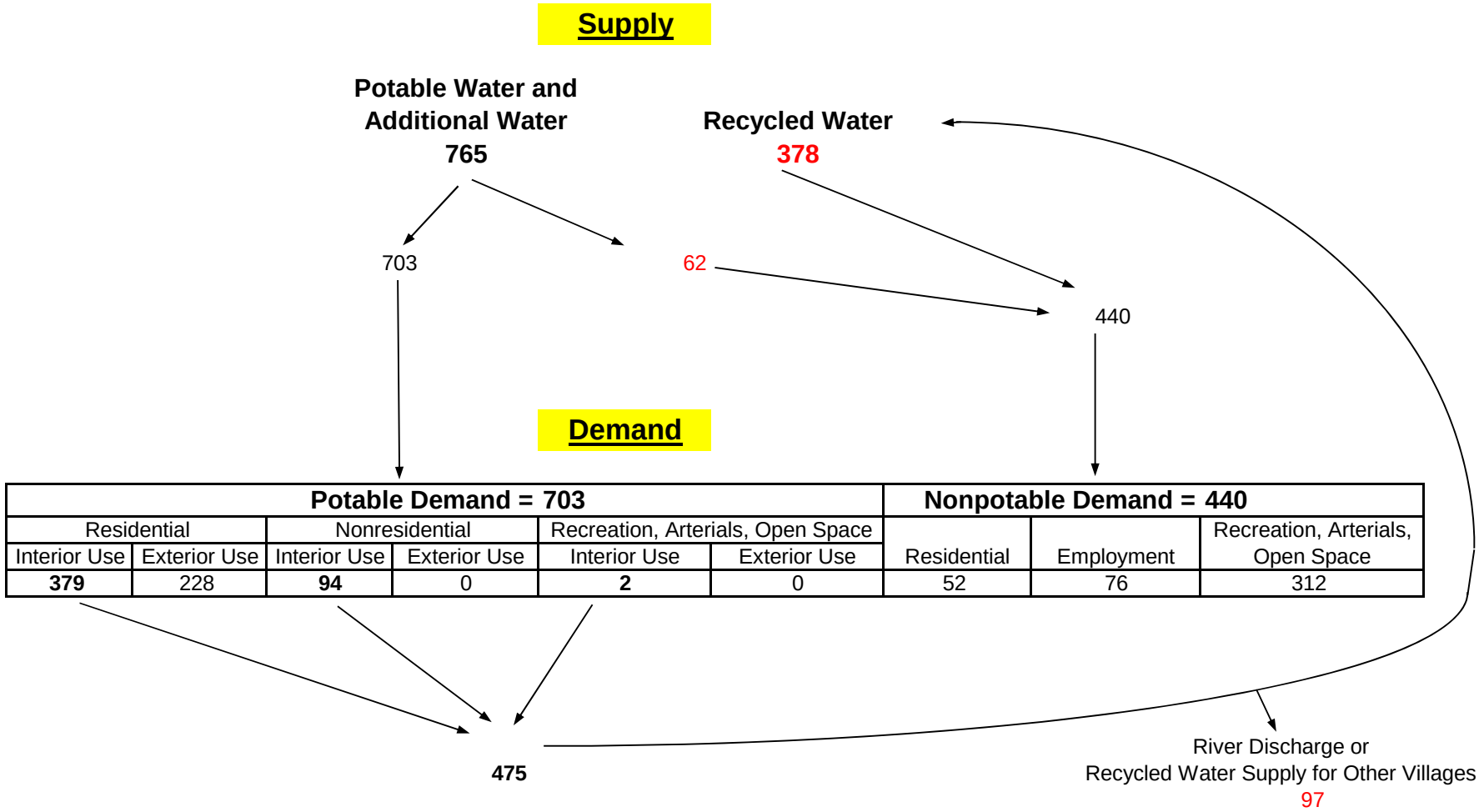
Recycled Water to Nonpotable						Potable Water Use (Ac-Ft per Month)			
Month	Recycled Water Supply	Nonpotable Demand	Net	Numbers used for Fig 8		Month	Nonpotable Demand	Potable Demand	Total
J	40	17	-24	40	17	J	0	49	49
F	36	22	-14	36	22	F	0	48	48
M	40	29	-11	40	29	M	0	55	55
A	39	40	1	39	40	A	1	60	61
M	40	46	6	40	46	M	6	64	71
J	39	50	11	39	50	J	11	65	76
J	40	62	22	40	62	J	22	73	94
A	40	57	17	40	57	A	17	70	86
S	39	45	6	39	45	S	6	62	68
O	40	33	-7	40	33	O	0	57	57
N	39	22	-17	39	22	N	0	50	50
D	40	17	-24	40	17	D	0	49	49
Totals	475	440	-35			Total	62	703	765
Sum of Negative = Discharged To River			-97					Check:	765 OKAY
Sum of Positive = Water Needed for Nonpotable Use			62						
	39.58333333								

ETO values based on Bullettin 1922.
HAND-INPUT DATA IN RED

1.37
1.85
2.39
3.31
3.84
4.13
5.13
4.7
3.72
2.73
1.82
1.37
36.36

Figure 1
Entrada Village South Water Balance

All units in acre-feet/year



Potable Demand = 703						Nonpotable Demand = 440		
Residential		Nonresidential		Recreation, Arterials, Open Space				
Interior Use	Exterior Use	Interior Use	Exterior Use	Interior Use	Exterior Use	Residential	Employment	Recreation, Arterials, Open Space
379	228	**94**	0	**2**	0	52	76	312

Note: The 62 ac-ft of additional water supply could be provided from the Valencia WRP or other available supplies.

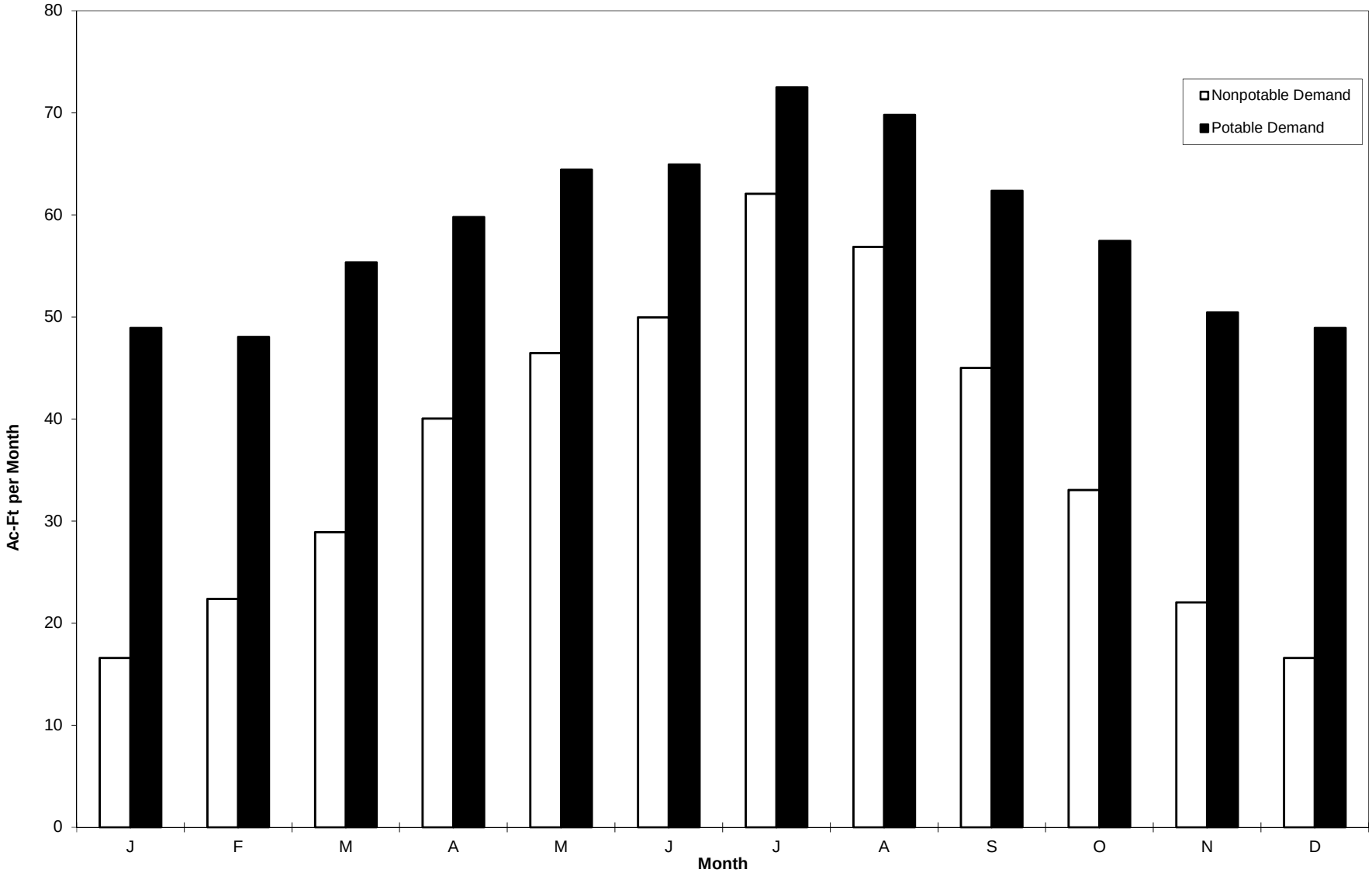


Figure 2
Total Monthly Water Demands
Entrada Village South

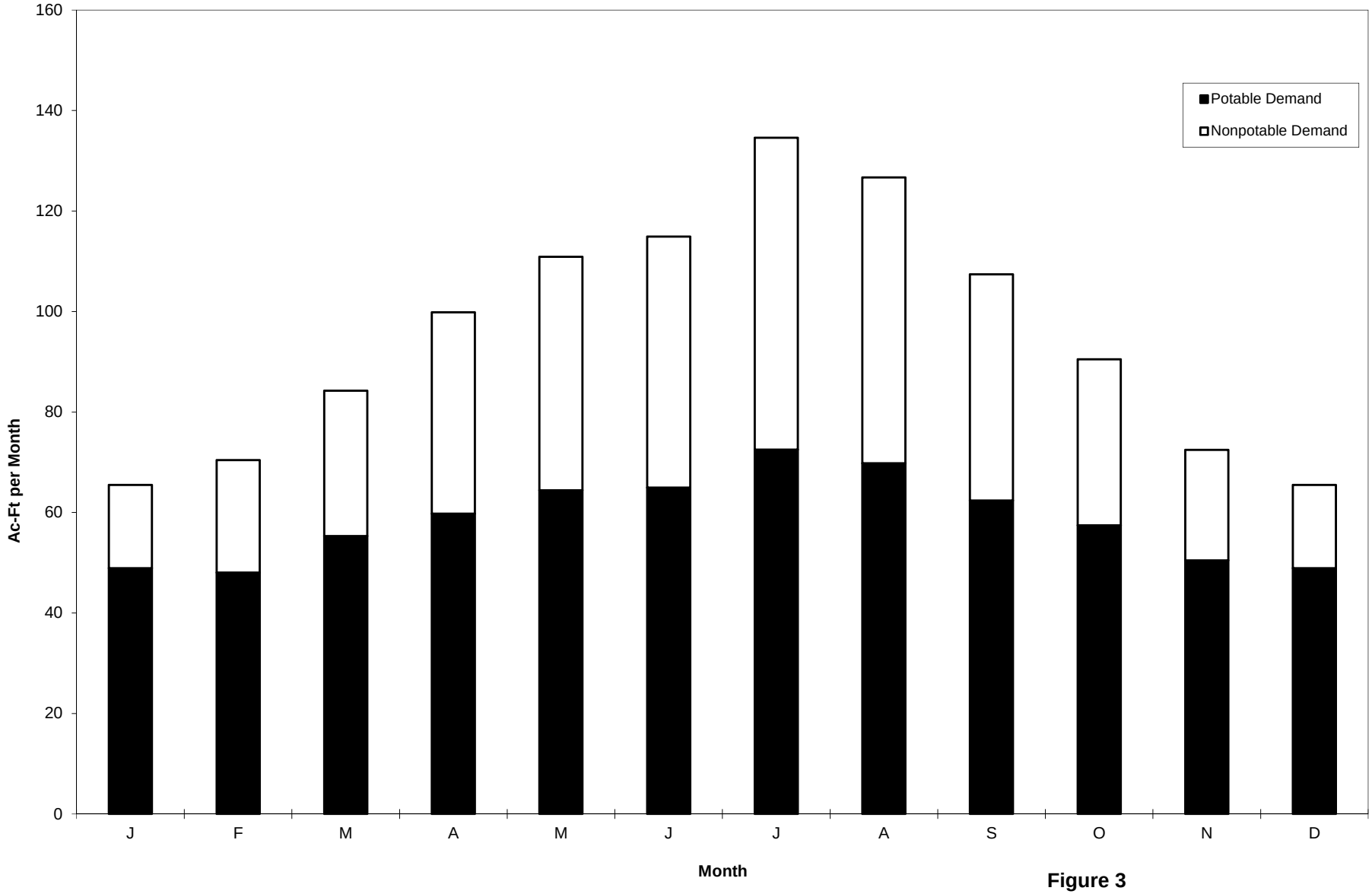
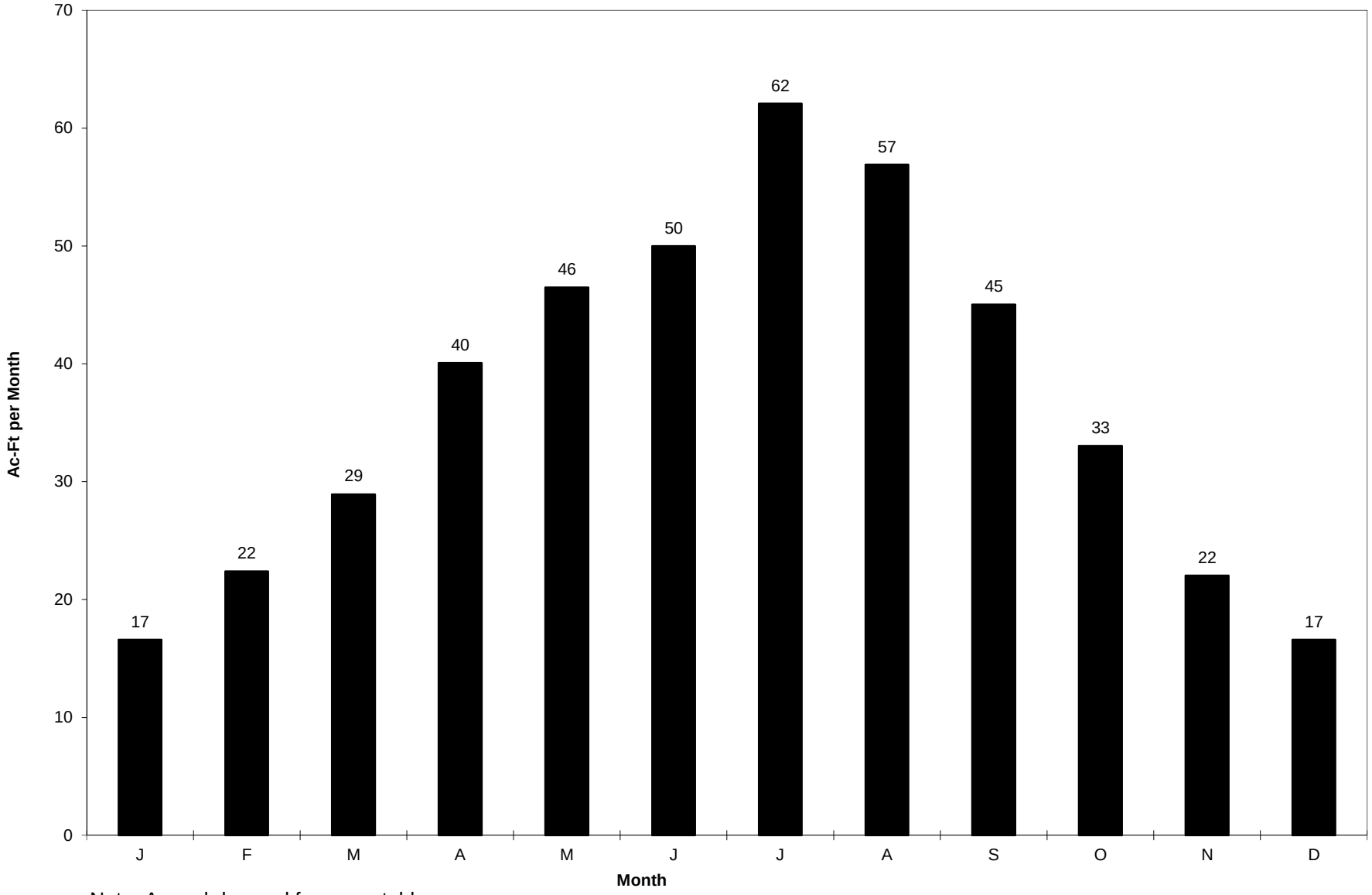
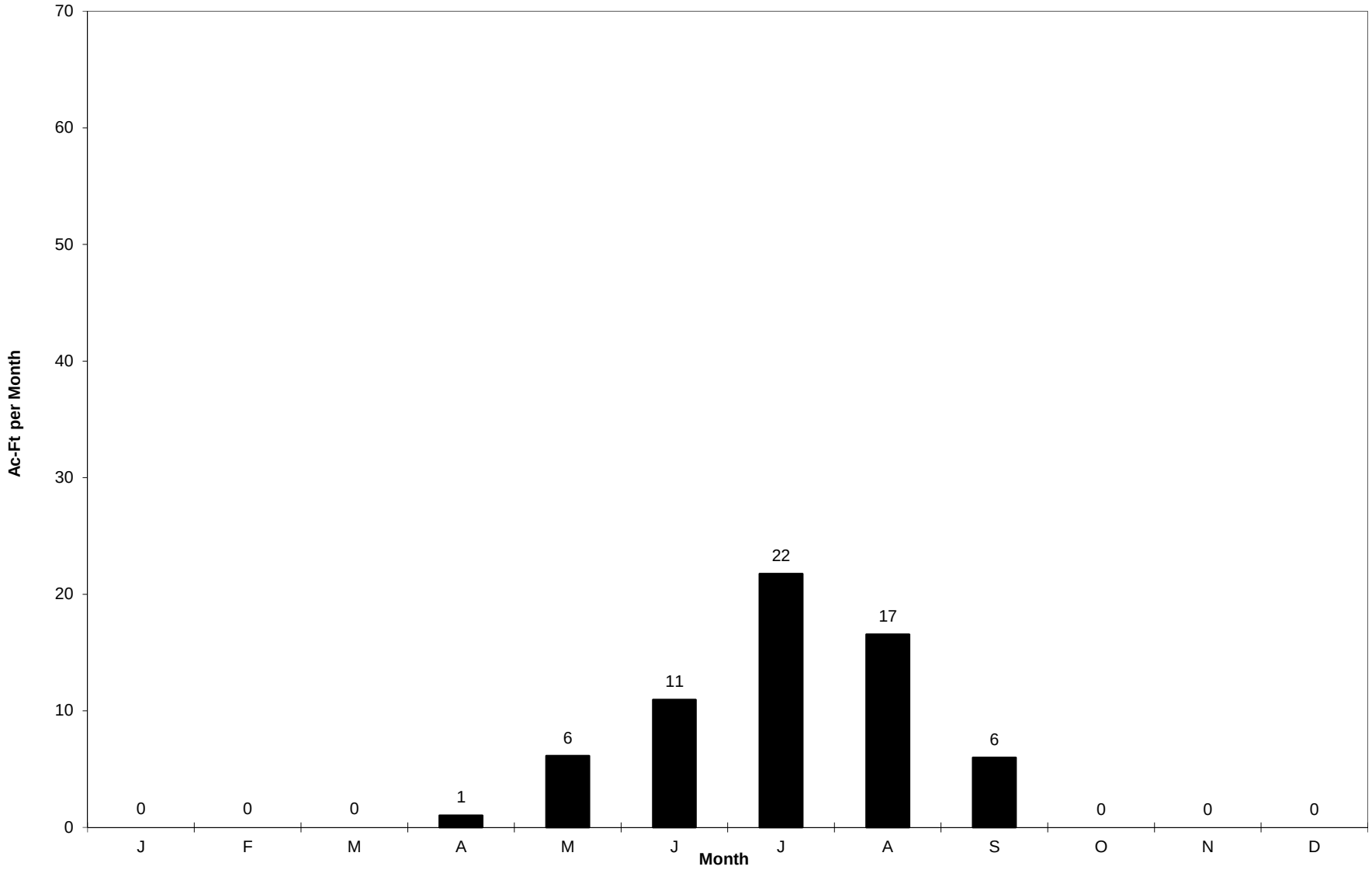


Figure 3
Total Monthly Water Demands
Entrada Village South



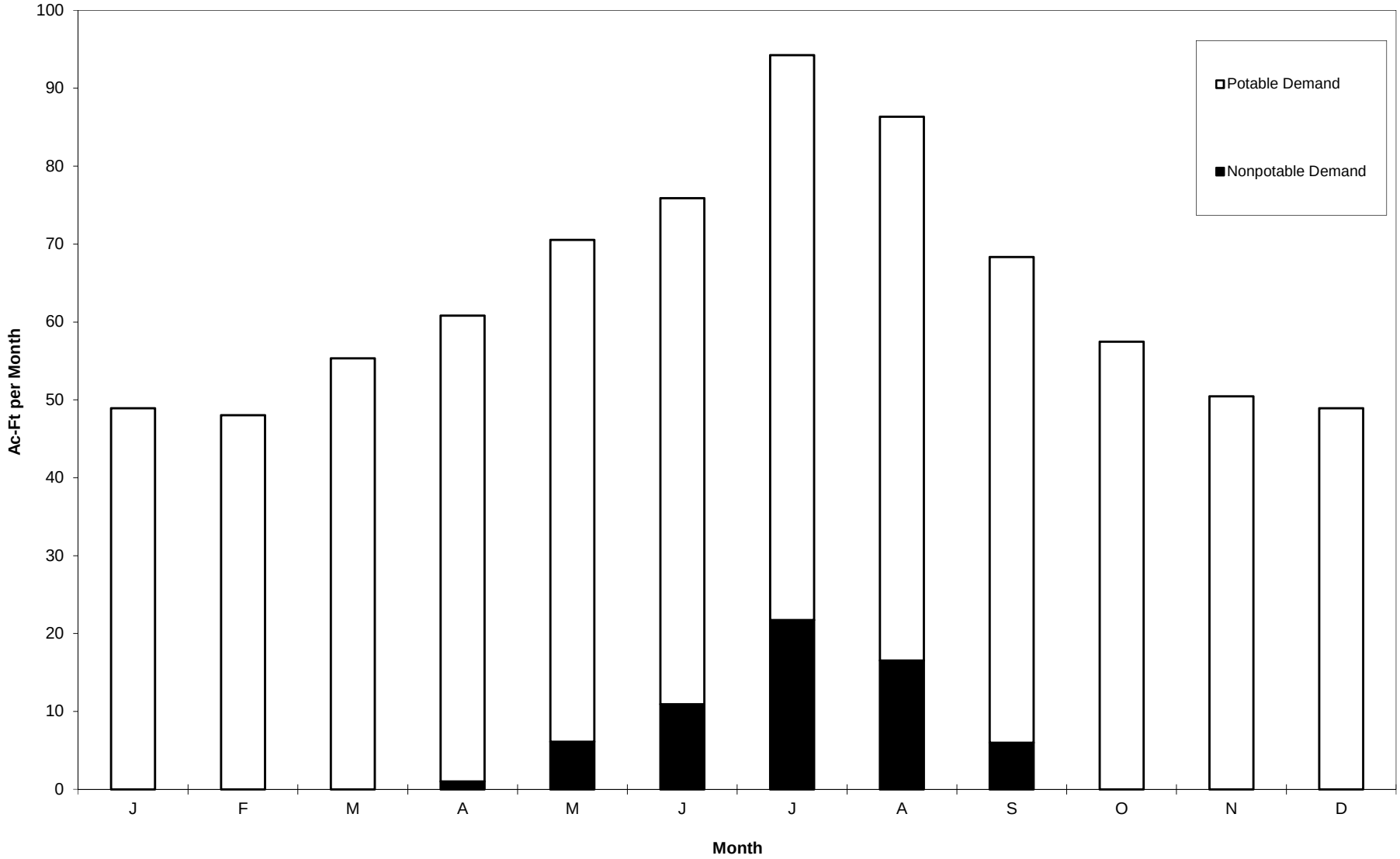
Note: Annual demand for nonpotable water is 440 ac-ft per year.

Figure 4
Monthly Nonpotable Water Demands
Entrada Village South



Note: Total additional water required is 62 ac-ft per year (from other nonpotable or potable sources).

Figure 5
Outdoor Water Demand Not Met By Nonpotable Water Generated By Entrada Village South



Note:
Annual supply from sources other than the recycled water flows generated by the Entrada Village South is 765 ac-ft per year. These supplies consist of supplies other than the recycled water generated within Entrada Village South. See Figure 1.

Figure 6
Uses of Potable and Other Nonpotable Water Supplies
Entrada Village South

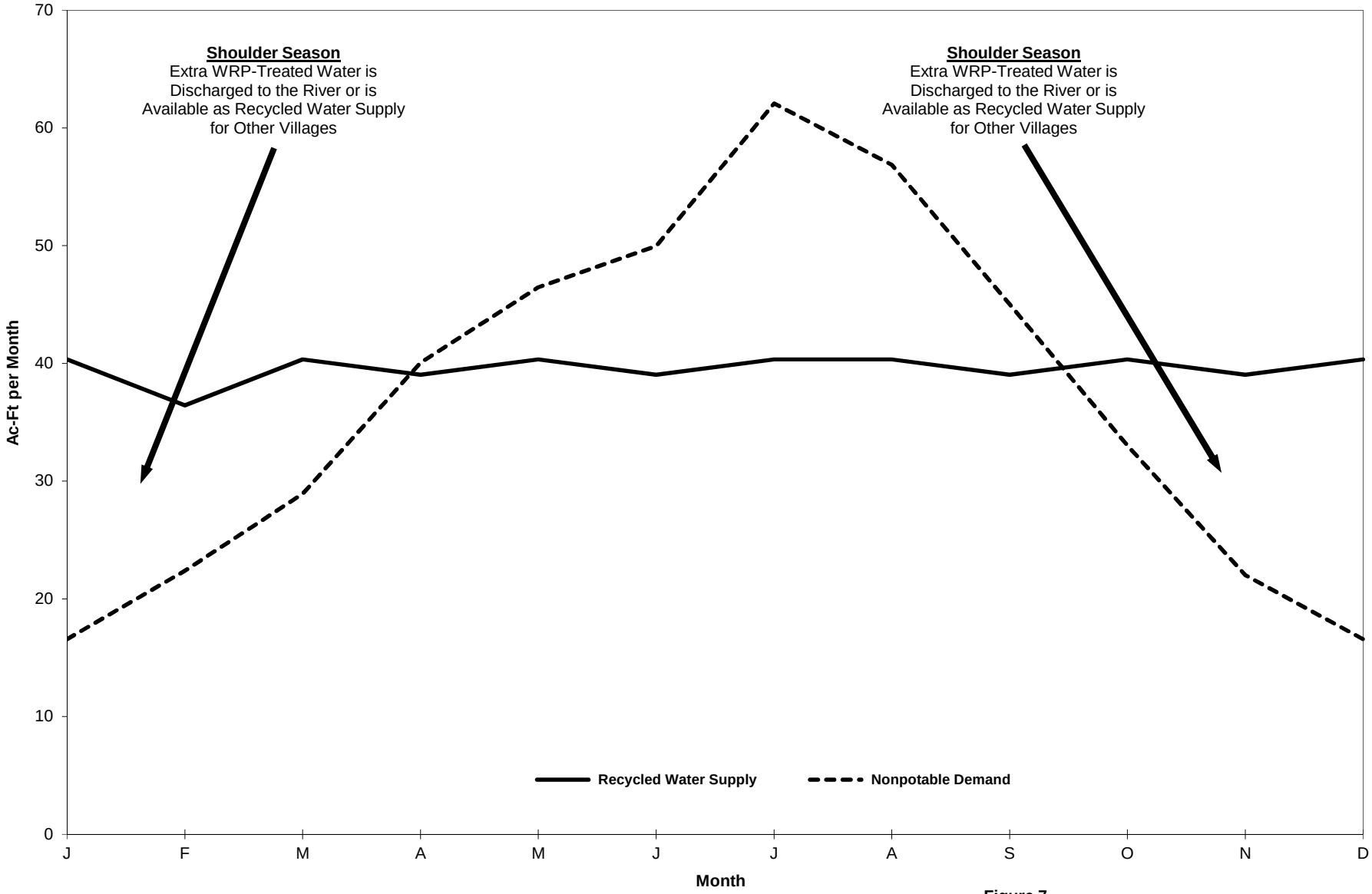
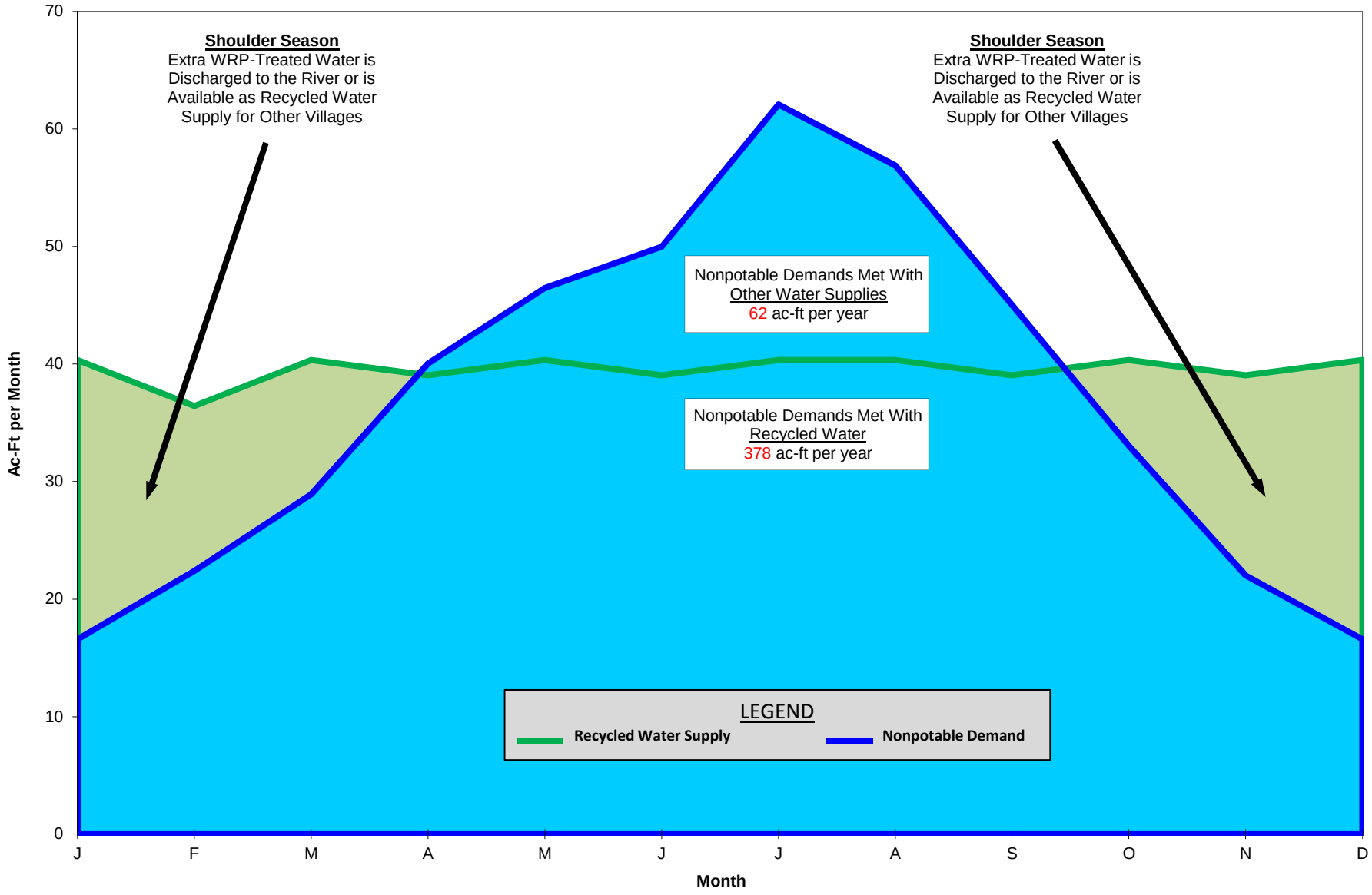


Figure 7
Comparison of Recycled Water Supply and Nonpotable Water Demands
Entrada Village South



Note: Total amount of WRP-treated water discharged to the Santa Clara River (or available as recycled water supply to other villages) is 97 ac-ft per year.

Figure 8
Recycled Water System Operations
Entrada Village South

Appendix D

CAPCOA GHG Reduction Strategies for Transportation – Entrada South VTTM

Stantec

Memo

To:	Alex Herrell Newhall Land	From:	Daryl Zerfass Stantec
File:	2073007070	Date:	July 14, 2014

Reference: CAPCOA GHG Reduction Strategies for Transportation – Entrada South (VTTM 53295)

An analysis of potential greenhouse gas (GHG) reduction strategies for the Entrada South (VTTM 53295) project has been prepared using mitigation measures documented in the California Air Pollution Control Officers Associates (CAPCOA) resource document "Quantifying Greenhouse Gas Mitigation Measures", August, 2010. The CAPCOA document provides specific mitigation measures proven to reduce vehicle miles traveled (VMT) and transportation generated GHG emissions, with step-by-step guidelines to quantify the VMT/GHG reductions based on the specific features of the subject project. The CAPCOA mitigation measures are presented in a Fact Sheet format.

For the Entrada South (VTTM 53295) project, Stantec and Environ reviewed the Project Design Features (PDFs) associated with the project and identified the CAPCOA mitigation measures (Fact Sheets) specifically applicable to the Entrada South (VTTM 53295) PDFs. For each applicable CAPCOA measure, the quantification methodology outlined in the Fact Sheet was utilized to calculate the amount of VMT and/or GHG reduction attributable to the mitigation measure.

The Entrada South (VTTM 53295) project is a mixed-use development consisting of residential, employment (commercial office and retail), and a neighborhood school. Trip generation reductions attributable to the Land Use/Location aspects of the project were calculated as a separate exercise using the MXD Trip Generation methodology. As such, the CAPCOA mitigation measures within the Land Use/Location category of Fact Sheets were excluded from the analysis presented here to avoid double counting of GHG reductions.

The attached Table 1, Entrada South GHG Reductions – CAPCOA Transportation Strategies, summarizes each applicable PDF along with a corresponding CAPCOA mitigation measure and lists the estimated VMT/GHG reduction applicable to the Entrada South (VTTM 53295) project. For each CAPCOA Fact Sheet utilized for GHG/VMT reduction calculations, the underlying project features and assumptions utilized in the calculations are summarized in Table 2, CAPCOA Fact Sheet Data – Entrada South. Note, however, that some of the CAPCOA strategies listed in Table 1 are grouped with other strategies in the same category and do not have a specific reduction calculation associated with them. Those strategies, specifically TST-2, TST-6, and SDT-9, supplement the primary strategy by improving its effectiveness but without specific assumptions such as those listed in Table 2.

If you have any questions on the enclosed material, please feel free to contact me to discuss.

STANTEC CONSULTING SERVICES INC.

Daryl Zerfass, PE
Principal, Transportation Planning and Traffic Engineering
Phone: (949) 923-6058
Daryl.Zerfass@stantec.com

Attachment: Table 1 Entrada South GHG Reductions – CAPCOA Transportation Strategies
Table 2 CAPCOA Fact Sheet Data – Entrada South

Table 1 Entrada South GHG Reductions – CAPCOA Transportation Strategies

Project Design Features	CAPCOA Fact Sheets	Entrada So. GHG or VMT Reduction
Bus pull-ins constructed throughout the Project site. Shuttle service from residential subdivisions/residential core areas to commercial core areas/worksite. On-site or off-site bus stops (e.g., bus turnouts, passenger benches, and shelters). Shuttles to major rail transit centers or multi-modal stations. Contribution to regional transit systems (e.g., right-of way, capital improvements, etc.). Lunch shuttle service from a worksite(s) to food establishments.	TST-2 Implement Transit Access Improvements[1] TST-3 Expand Transit Network TST-6 Provide Local Shuttles[1] [1]Grouped with TST-3	1.7%
Pedestrian facilities, such as sidewalks, and community regional, and local trails, provided throughout the Project site. Roads with adjacent trails for pedestrian and bicycle use provided throughout the Project site connecting the individual Villages and community. Off-site pedestrian facility improvements, such as overpasses and wider sidewalks. Land for the provision of off-site bicycle trails linking the facility to designated bicycle commuting routes. Any two of the following: 1) Construct off-site bicycle facility improvements, such as bicycle trails linking the facility to designated bicycle commuting routes, or on-site improvements, such as bicycle paths; 2) Include bicycle parking facilities, such as bicycle lockers and racks; 3) Include showers for bicycling employees' use. Any two of the following: 1) Construct off-site pedestrian facility improvements, such as overpasses, wider sidewalks; 2) Construct on-site pedestrian facility improvements, such as building access which is physically separated from street and parking lot traffic and walk paths; 3) Include showers for pedestrian employees' use.	SDT-1 Provide Pedestrian Network Improvements SDT-9 Dedicated Land for Bike Trails[2] [2]Grouped with SDT-1	2%
Satellite telecommunications centers in residential subdivisions.	TRT-6 Telecommuting and Alternative Work Schedules	0.2% (2.2% of Res. Commuter VMT)
Synchronized traffic lights on streets impacted by development.	RPT-2 Improve Traffic Flow	1.4%
Preferential parking spaces for carpools and vanpools and 7'2" minimum vertical clearance in parking facilities for vanpool access.	TRT-1 Voluntary Commute Trip Reduction	1.0% (5.4% of Commuter VMT)
Traffic calming measures for on-site roadways and intersections.	SDT-2 Provide Traffic Calming Measures	0.75%
Ride-sharing program with dedicated parking areas.	TRT-3 Provide Ride-Sharing Programs	1.8% (10% of Commuter VMT)
Total Reduction (based on all of the above)		8.85%

Table 2 CAPCOA Fact Sheet Data – Entrada South

CAPCOA Fact Sheet	Project Features/Assumptions
TST-3 Expand Transit Network *(Project Description)*	Existing Transit Coverage = Santa Clarita Transit (SCT) Route 3 (9.0 miles) & Route 7 (10.7 miles) Future Estimated Coverage: Route to Valencia Commerce Center (8.5 miles) Route to Valencia Industrial Center (6.8 miles) Route to Newhall Metrolink Station (6.5 miles) B = Elasticity of Transit Ridership with respect to service coverage (source: CAPCOA) $B_{(Suburban)}$ = 1.01 $B_{(Urban)}$ = 0.72 $B_{(Average)}$ = 0.865 Mode = Existing Transit Mode Share (source: CAPCOA) $Mode_{(Suburban)}$ = 1.3% $Mode_{(Urban)}$ = 4% $Mode_{(Average)}$ = 2.65% D=0.67 (source: CAPCOA) where % VMT Reduction = $Coverage_{(\%\ Increase)}$ * B * Mode * D
SDT-1 Provide Pedestrian Network Improvements *(Project Description)*	Pedestrian accommodations (e.g., internally links all uses and connects to all exiting or planned external streets and pedestrian facilities contiguous within the project site; minimize barriers to pedestrian access and interconnectivity; physical barriers such as walls, landscaping, and slopes that impede pedestrian circulation will be eliminated) are within Project Site and Connecting Off-Site (Urban & Suburban) = 2% VMT Reduction (source: CAPCOA)
TRT-6 Telecommuting and Alternative Work Schedules *(Project Design Feature)*	Telecommuting Employee Participation (1.5 days/week) = 10% (estimate, see notes below) % Reduction in Commute VMT = 2.2% (source: CAPCOA) Commute Trips = 20% of Total Trips (source: CAPCOA) Notes: For NRSP MM 4.10-9.a, telecommuting participation is applied to project residents only. The 2012 American Community Survey provides data on workers who primarily telecommute (2.6% of the workforce). [1] Additional data indicates that 25 million workers (approximately 16% of the workforce) telecommute at least once per month, that 50% of the current U.S. labor force holds a job that is compatible with at least part-time telework, and that 79% of U.S. workers say they would like to work from home at least part of the time (source: GlobalWorkplaceAnalytics.com). [2] Taken together, the above data supports an estimate of 10% participation for workers to telecommute 1.5 days/week.

Continued

[1] Latest Telecommuting Statistics (n.d.) Retrieved from http://www.globalworkplaceanalytics.com/telecommuting-statistics (accessed May 29, 2014).
[2] ibid

Table 2 CAPCOA Fact Sheet Data – Entrada South (Continued)

CAPCOA Fact Sheet	Project Features/Assumptions
RPT-2 Improve Traffic Flow *(Project Design Feature)*	Traffic Signal Coordination for: Magic Mountain Parkway from Commerce Center Drive to The Old Road (1.0 miles) The Old Road from Skyview Lane to Shopping Center Driveway (south of Magic Mountain Parkway) (0.5 miles) Average Running Speed = 25 mph Project VMT = No change (pre/post) Emission Factor $(EF)_{(congested)}$=371 CO_2/mile (source: CAPCOA) $EF_{(free\text{-}flow)}$=262 CO_2/mile (source: CAPCOA) Notes: Traffic Signal Coordination results in synchronized operation of multiple consecutive intersections along a roadway corridor or network to enhance the operation of one or more directional movements in a system. Coordination typically includes the ability for signals to communicate between each other and/or a central Traffic Management Center (TMC) through the use of hard-wire connections or radio frequencies. Special traffic signal timing plans are utilized to maintain progression in one or more directions or to minimize average vehicle delay.
TRT-1 Voluntary Commute Trip Reduction *(Project Design Feature)*	Voluntary Commute Trip Reduction (CTR) program (e.g., carpooling encouragement; ride-matching assistance; preferential carpool parking; flexible work schedules for carpools; half-time transportation coordinator; vanpool assistance; bicycle end-trip facilities) A = % reduction in commute VMT = 5.4% (Suburban Center) (source: CAPCOA) B = % employees eligible = 100% (estimate) Where %VMT Reduction(Office) = A*B Notes: Entrada South will also participate in the overall Newhall Ranch Specific Plan mitigation requirements for traffic demand management (TDM).
SDT-2 Provide Traffic Calming Measures *(Project Description)*	On-site pedestrian/bicycle safety and traffic calming measures in excess of jurisdiction requirements to encourage people to walk or bike instead of using a vehicle and roadways designed to reduce motor vehicle speeds (e.g., marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, and others) % of streets with improvements = 100% % of intersections with improvements = 50% % VMT Reduction = 0.75 (source: CAPCOA) Notes: SDT-2 differs from SDT-1 (Provide Pedestrian Network Improvements) by providing a more attractive walking environment through the reduction and slowing of roadway traffic volumes. In comparison, SDT-1 provides the actual infrastructure needed by pedestrians.

Continued

Table 2 CAPCOA Fact Sheet Data – Entrada South (Continued)

CAPCOA Fact Sheet	Project Features/Assumptions
TRT-3 Provide Ride-Sharing Programs *(Project Design Feature)*	Include a ride-sharing program as well as a permanent transportation management association membership and funding requirement. Funding may be provided by Community Facilities, District, or County Service Area, or other non-revocable funding mechanism. Promote ride-sharing programs through a multi-faceted approach such as: Designating a certain percentage of parking spaces for ride sharing vehicles Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles Providing a web site or message board for coordinating rides Commute = % reduction in commute VMT = 10% (Suburban Center) (source: CAPCOA) Employee = % employees eligible = 100% (estimate) Where %VMT Reduction(Office) = Commute*Employee Notes: TRT-3 differs from TRT-1 (Voluntary Commute Trip Reduction) by focusing on the promotion of funded ride-sharing programs at the workplace. In comparison TRT-1 is based on a voluntary and multifaceted Commute Trip Reduction (CTR) program that includes "carrots" and "sticks" to encourage employees to utilize alternative modes of transportation.

Appendix E

Entrada South Trip Rate and Trip Length Discussion

Stantec

Memo

To:	Min Hou	From:	Daryl Zerfass
	Environ		Stantec
File:	2073007070	Date:	April 7, 2014

Reference: Entrada South Trip Rate & Trip Length Discussion

Following is a brief discussion on the trip rate and trip length characteristics for the Entrada South project. The discussion is intended to be used as reference for the project's greenhouse gas (GHG) technical report.

As discussed in Section 1.3.1 of the project's traffic study, future year traffic forecasts are derived using the Santa Clarita Valley Consolidated Traffic Model (SCVCTM), a sophisticated travel demand model. The SCVCTM has the capability of forecasting the complex interaction of vehicle trips between existing and future land uses using industry standard procedures. Inherent to this trip distribution process is a quantification of trips by "trip type".

As the name suggests, "trip type" refers to the kind of trip that is being made based on its purpose. Models such as the SCVCTM commonly utilize five trip types, as follows:

H-W: Home-based work trips
H-S: Home-based shopping trips
H-O: Home-based "other" (i.e., non-work, non-shopping) trips
O-W: Other-based work trips
O-O: Other-based other trips

Each trip type has unique characteristics, which are reflected in the model. For example, home-based work trips are distributed based on factors that generally result in longer trip lengths than the trip lengths that are calculated for home-based shopping trips. All trips that are generated within the model limits, both existing and future trips, are first categorized into one of the five trip types. The model then calculates the distribution of each traffic analysis zone based on the trip type. The final step of the trip distribution process aggregates all the trips together into a single trip table matrix that includes all five trip types.

Through the trip distribution process described above, the appropriate trip length characteristic of the various types of trips is reflected in the traffic forecasting process. The average trip lengths that are estimated using the model thereby account for the differing trip lengths of the various trip types.

The SCVCTM has been utilized in a number of prior transportation planning studies for the Santa Clarita Valley, such as the One Valley One Vision County Area Plan/City General Plan Update. That study effort produced average trip length estimates for various land use and transportation network scenarios. The OVOV plan that was ultimately adopted by the County and the City was estimated to have an average trip length of 11.6 miles. This average trip length represents an aggregate of the five unique trip types as discussed above.

The trip distribution and trip assignment processes utilized by travel demand models such as the SCVCTM estimate primary trips as well as trips commonly referred to as diverted trips and pass-by

Reference: Entrada South Trip Rate & Trip Length Discussion

trips. When utilizing traffic forecasts produced by the SCVCTM, there is not a need to undertake additional steps to estimate the number of diverted trips or pass-by trips since they are reflected in the total trip forecasts produced by the model.

Should you have any questions or need further clarification on the trip type summary provided above, please feel free to contact me to discuss.

STANTEC CONSULTING SERVICES INC.

Daryl Zerfass, PE, PTP
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c. Miles Helfrich, Newhall Land
Alex Herrell, Newhall Land

Appendix F

SCAG RTP/SCS Land Use Analysis for the Newhall Land Westside Areas

Stantec

Memo

To:	Alex Herrell Newhall Land	From:	Daryl Zerfass Stantec
File:	2073008220	Date:	November 22, 2013

Reference: SCAG RTP/SCS Land Use Analysis for the Newhall Land Westside Areas

In April, 2012, the Southern California Association of Governments (SCAG) adopted the 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). The RTP/SCS includes projections of population growth for the SCAG region and estimates that an additional 4 million people will be added to the region by 2035.

The Newhall Ranch Specific Plan represents an area of future growth and is reflected in the County's Area Plan for the Santa Clarita Valley. An analysis has been prepared by Stantec in which the RTP/SCS projections are compared to the planned Newhall Land development projects. The Newhall Land development areas included with this analysis consist of the Newhall Ranch Specific Plan area along with the adjacent Entrada North, Entrada South, Legacy Village and Commerce Center areas (collectively referred to here as the Newhall Land Westside area).

To assess the amount of future growth assumed by the RTP/SCS, population and housing data was obtained from SCAG by Environ in August, 2013, and subsequently provided to Stantec for analysis. The RTP/SCS data was provided in ArcGIS format and was organized by SCAG Tier 2 traffic analysis zone (TAZ) boundaries. The SCAG TAZs were overlaid on the Santa Clarita Valley Consolidated Traffic Model (SCVCTM) TAZ system and housing data was extracted for identical geographical areas. An exhibit showing the relationship of the SCAG TAZs to the SCVCTM TAZs is attached for reference.

SCAG TAZ boundaries are significantly larger than the SCVCTM TAZs, and the SCAG TAZs cover an area larger than the actual Newhall Land Westside area. Therefore, in order to have a geographically consistent comparison between the two data sets, an area much larger than just the Newhall Land Westside area was used as the basis for analysis.

For the RTP/SCS, the data represents the total number of households (HH) within the TAZ boundaries in the year 2035. For comparison purposes, the total amount of planned development for the Newhall Land Westside area (21,771 HH) was combined with all known planned and proposed development projects (617 HH) as previously submitted to the County (i.e., "Cumulative Projects"), together with existing land use for the area (7,790 HH) based on SCVCTM zones. A comparison of the two data sets is provided below, which shows that the RTP/SCS household data is generally consistent with the number of planned residential units depicted by the Newhall Land Westside and County data on an aggregate level.

Tier2 TAZ	RTP/SCS 2035 HH	NL/County HH	Difference
20224100	2,578	2,689	111
20224200	10	0	-10
20226100	20,182	21,975	1,793
20227100	7,006	5,514	-1,492
Total	***29,776***	***30,178***	***402***

Reference: SCAG RTP/SCS Land Use Analysis for the Newhall Land Westside Areas

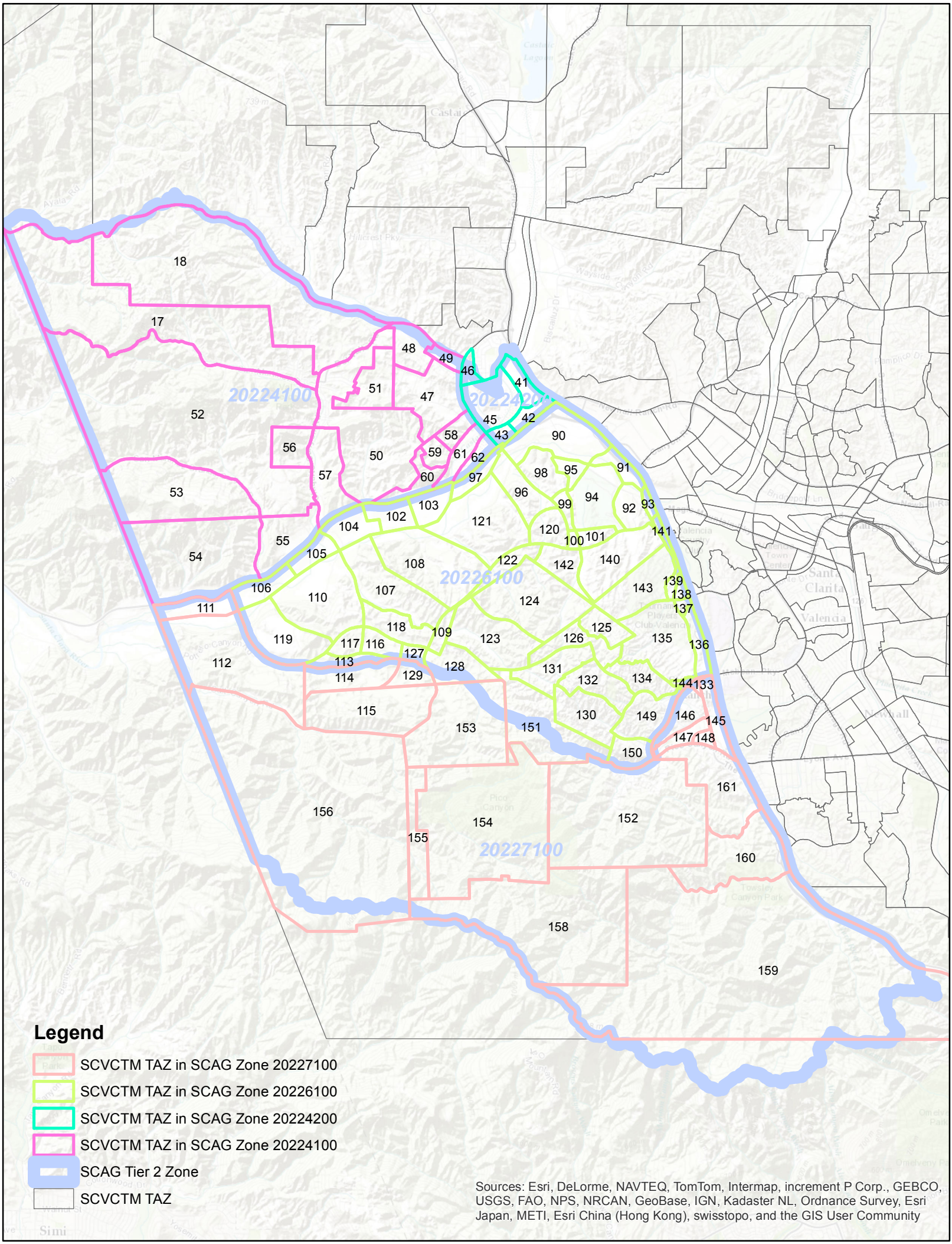
Zone boundary differences are reflected in the zonal comparison provide above. For example, while the SCAG zone 20226100 area shows 1,793 more households with the Newhall Land Westside and County data, the neighboring SCAG zone 20227100 shows 1,492 fewer households with the Newhall Land Westside and County data. North of the SR-126, there is also a slight difference of 101 more households. In total, the difference between the Newhall Land Westside/County data and the RTP/SCS data is 402 households (1.4 percent). Due to the large size of the SCAG TAZs, it is not possible to discern if the indicated differences are due to land uses within or outside of the actual Newhall Land Westside project area boundaries.

If you have any questions on the enclosed material, please feel free to contact me to discuss.

STANTEC CONSULTING SERVICES INC.

Daryl Zerfass, PE
Principal, Transportation Planning and Traffic Engineering
Phone: (949) 923-6058
Daryl.Zerfass@stantec.com

Attachment: Exhibit – SCAG Tier 2 TAZ and SCVCTM TAZ boundaries


20224100
20224200
20226100
20227100
Legend
SCVCTM TAZ in SCAG Zone 20227100
SCVCTM TAZ in SCAG Zone 20226100
SCVCTM TAZ in SCAG Zone 20224200
SCVCTM TAZ in SCAG Zone 20224100
SCAG Tier 2 Zone
SCVCTM TAZ
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Appendix 5.7B

Climate Change Scoping Plan

California Air Resources Board

December 2008

Climate Change Scoping Plan

a framework for change

DECEMBER 2008

Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

Arnold Schwarzenegger
Governor

Linda S. Adams
Secretary, California Environmental Protection Agency

Mary D. Nichols
Chairman, Air Resources Board

James N. Goldstene
Executive Officer, Air Resources Board

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EXECUTIVE SUMMARY

On September 27, 2006, Governor Schwarzenegger signed Assembly Bill 32, the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). The event marked a watershed moment in California's history. By requiring in law a reduction of greenhouse gas (GHG) emissions to 1990 levels by 2020, California set the stage for its transition to a sustainable, clean energy future. This historic step also helped put climate change on the national agenda, and has spurred action by many other states.

The California Air Resources Board (ARB or Board) is the lead agency for implementing AB 32, which set the major milestones for establishing the program. ARB met the first milestones in 2007: developing a list of discrete early actions to begin reducing greenhouse gas emissions, assembling an inventory of historic emissions, establishing greenhouse gas emission reporting requirements, and setting the 2020 emissions limit.

ARB must develop a Scoping Plan outlining the State's strategy to achieve the 2020 greenhouse gas emissions limit. This Scoping Plan, developed by ARB in coordination with the Climate Action Team (CAT), proposes a comprehensive set of actions designed to reduce overall greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health.

This "Approved Scoping Plan" was adopted by the Board at its December 11, 2008 meeting. The measures in this Scoping Plan will be developed over the next two years and be in place by 2012.

Reduction Goals

This plan calls for an ambitious but achievable reduction in California's carbon footprint. Reducing greenhouse gas emissions to 1990 levels means cutting approximately 30 percent from business-as-usual emission levels projected for 2020, or about 15 percent from today's levels. On a per-capita basis, that means reducing our annual emissions of 14 tons of carbon dioxide equivalent for every man, woman and child in California down to about 10 tons per person by 2020. This challenge also presents a magnificent opportunity to transform California's economy into one that runs on clean and sustainable technologies, so that all Californians are able to enjoy their rights in the future to clean air, clean water, and a healthy and safe environment.

Significant progress can be made toward the 2020 goal relying on existing technologies and improving the efficiency of energy use. A number of solutions are "off the shelf," and many – especially investments in energy conservation and efficiency – have proven economic benefits. Other solutions involve improving our state's infrastructure, transitioning

to cleaner and more secure sources of energy, and adopting 21st century land use planning and development practices.

A Clean Energy Future

Getting to the 2020 goal is not the end of the State's effort. According to climate scientists, California and the rest of the developed world will have to cut emissions by 80 percent from today's levels to stabilize the amount of carbon dioxide in the atmosphere and prevent the most severe effects of global climate change. This long range goal is reflected in California Executive Order S-3-05 that requires an 80 percent reduction of greenhouse gases from 1990 levels by 2050.

Reducing our greenhouse gas emissions by 80 percent will require California to develop new technologies that dramatically reduce dependence on fossil fuels, and shift into a landscape of new ideas, clean energy, and green technology. The measures and approaches in this plan are designed to accelerate this necessary transition, promote the rapid development of a cleaner, low carbon economy, create vibrant livable communities, and improve the ways we travel and move goods throughout the state. This transition will require close coordination of California's climate change and energy policies, and represents a concerted and deliberate shift away from fossil fuels toward a more secure and sustainable future. This is the firm commitment that California is making to the world, to its children and to future generations.

Making the transition to a clean energy future brings with it great opportunities. With these opportunities, however, also come challenges. As the State moves ahead with the development and implementation of policies to spur this transition, it will be necessary to ensure that they are crafted to not just cut greenhouse gas emissions and move toward cleaner energy sources, but also to ensure that the economic and employment benefits that will accompany the transition are realized in California. This means that particular attention must be paid to fostering an economic environment that promotes and rewards California-based investment and development of new technologies and that adequate resources are devoted to building and maintaining a California-based workforce equipped to help make the transition.

A Public Process

Addressing climate change presents California with a challenge of unprecedented scale and scope. Success will require the support of Californians up and down the state. At every step of the way, we have endeavored to engage the public in the development of this plan and our efforts to turn the tide in the fight against global warming.

In preparing the Draft Scoping Plan, ARB and CAT subgroups held dozens of workshops, workgroups, and meetings on specific technical issues and policy measures. Since the release of the draft plan in late June, we have continued our extensive outreach with workshops and webcasts throughout the state. Hundreds of Californians showed up to share their thoughts about the draft plan, and gave us their suggestions for improving it. We've received thousands of postcards, form letters, emails, and over 1,000 unique comments

posted to our website or sent by mail. All told, more than 42,000 people commented on the draft Plan.

ARB catalogued and publicly posted all the comments we received. In many instances, we engaged experts and staff at our partner agencies for additional evaluation of comments and suggestions.

This plan reflects the input of Californians at every level. Our partners at other State agencies, in the legislature, and at the local government level have provided key input. We've met with members of community groups to address environmental justice issues, with representatives of California's labor force to ensure that good jobs accompany our transition to a clean energy future, and with representatives of California's small businesses to ensure that this vital part of our state's economic engine flourishes under this plan. We've heeded the advice of public health and environmental experts throughout the state to design the plan so that it provides valuable co-benefits in addition to cutting greenhouse gases. We've also worked with representatives from many of California's leading businesses and industries to craft a plan that works in tandem with the State's efforts to continue strong economic growth.

In short, we've heard from virtually every sector of California's society and economy, reflecting the fact that the plan will touch the life of almost every Californian in some way.

Scoping Plan Recommendations

The recommendations in this plan were shaped by input and advice from ARB's partners on the Climate Action Team, as well as the Environmental Justice Advisory Committee (EJAC), the Economic and Technology Advancement Advisory Committee (ETAAC), and the Market Advisory Committee (MAC). Like the Draft Scoping Plan, the strength of this plan lies in the comprehensive array of emission reduction approaches and tools that it recommends.

Key elements of California's recommendations for reducing its greenhouse gas emissions to 1990 levels by 2020 include:

- **Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;**
- **Achieving a statewide renewables energy mix of 33 percent;**
- **Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;**
- **Establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;**

- **Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and**
- **Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long term commitment to AB 32 implementation.**

After Board approval of this plan, the measures in it will be developed and adopted through the normal rulemaking process, with public input.

Key Changes

This plan is built upon the same comprehensive approach to achieving reductions as the draft plan. However, as a result of the extensive public comment we received, this plan includes a number of general and measure-specific changes. The key changes and additions follow.

Additional Reports and Supplements

1. Economic and Public Health Evaluations: This plan incorporates an evaluation of the economic and public health benefits of the recommended measures. These analyses follow the same methodology used to evaluate the Draft Scoping Plan.[1]

2. CEQA Evaluation: This plan includes an evaluation of the potential environmental impacts of the Scoping Plan under the California Environmental Quality Act (CEQA).[2]

Programmatic Changes

1. Margin of Safety for Uncapped Sectors: The plan provides a 'margin of safety,' that is, additional reductions beyond those in the draft plan to account for measures in uncapped sectors that do not, or may not, achieve the estimated reduction of greenhouse gas emissions in this plan. Along with the certainty provided by the cap, this will ensure that the 2020 target is met.

2. Focus on Labor: The plan includes a discussion of issues directly related to California's labor interests and working families, including workforce development and career technical education. This additional element reflects ARB's existing activities and expanded efforts by State agencies, such as the Employment Development Department, to ensure that California will have a green technology workforce to address the challenges and opportunities presented by the transition to a clean energy future.

[1] Staff will provide an update to the Board to respond to comments received on these analyses.

[2] This evaluation is contained in Appendix J.

3. Long Term Trajectory: The plan includes an assessment of how well the recommended measures put California on the long-term reduction trajectory needed to do our part to stabilize the global climate.

4. Carbon Sequestration: The plan describes California's role in the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon capture and sequestration opportunities. In addition, the plan expresses support for near-term development of sequestration technology. This plan also acknowledges the important role of terrestrial sequestration in our forests, rangelands, wetlands, and other land resources.

5. Cap-and-Trade Program: The plan provides additional detail on the proposed cap-and-trade program including a discussion regarding auction of allowances, a discussion of the proposed role for offsets, the role of voluntary renewable power purchases, and additional detail on the mechanisms to be developed to encourage voluntary early action.

6. Implementation: The plan provides additional detail on implementation, tracking and enforcement of the recommended actions, including the important role of local air districts.

Changes to Specific Measures and Programs

1. Regional Targets: ARB re-evaluated the potential benefits from regional targets for transportation-related greenhouse gases in consultation with regional planning organizations and researchers at U.C. Berkeley. Based on this information, ARB increased the anticipated reduction of greenhouse gas emissions for Regional Transportation-Related Greenhouse Gas Targets from 2 to 5 million metric tons of CO_2 equivalent ($MMTCO_2E$).

2. Local Government Targets: In recognition of the critical role local governments will play in the successful implementation of AB 32, ARB added a section describing this role. In addition, ARB recommended a greenhouse gas reduction goal for local governments of 15 percent below today's levels by 2020 to ensure that their municipal and community-wide emissions match the State's reduction target.

3. Additional Industrial Source Measures: ARB added four additional measures to address emissions from industrial sources. These proposed measures would regulate fugitive emissions from oil and gas recovery and transmission activities, reduce refinery flaring, and require control of methane leaks at refineries. We

anticipate that these measures will provide 1.5 $MMTCO_2E$ of greenhouse gas reductions.

4. Recycling and Waste Re-Assessment: In consultation with the California Integrated Waste Management Board, ARB re-assessed potential measures in the Recycling and Waste sector. As a result of this review, ARB increased the anticipated reduction of greenhouse gas emissions from the Recycling and Waste Sector from 1 to 10 $MMTCO_2E$, incorporating measures to move toward high recycling and zero-waste.[3]

5. Green Building Sector: This plan includes additional technical evaluations demonstrating that green building systems have the potential to reduce approximately 26 $MMTCO_2E$ of greenhouse gases. These tools will be helpful in reducing the carbon footprint for new and existing buildings. However, most of these greenhouse gas emissions reductions will already be counted in the Electricity, Commercial/Residential Energy, Water or Waste sectors and are not separately counted toward the AB 32 goal in this plan.

6. High Global Warming Potential (GWP) Mitigation Fee: Currently many of the chemicals with very high Global Warming Potential (GWP)—typically older refrigerants and constituents of some foam insulation products—are relatively inexpensive to purchase. ARB includes in this plan a Mitigation Fee measure to better reflect their impact on the climate. The fee is anticipated to promote the development of alternatives to these chemicals, and improve recycling and removal of these substances when older units containing them are dismantled.

7. Modified Vehicle Reductions: Based on current regulatory development, ARB modified the expected emissions reduction of greenhouse gases from the Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) measure and the Tire Inflation measure. The former measure is now expected to achieve 0.9 $MMTCO_2E$ while the latter is now expected to achieve 0.4 $MMTCO_2E$.

8. Discounting Low Carbon Fuel Standard Reductions: ARB modified the expected emission reductions from the Low Carbon Fuel Standard to reflect overlap in claimed benefits with California's clean car law (the Pavley greenhouse gas vehicle standards). This has the result of discounting expected reduction of greenhouse gas emissions from the Low Carbon Fuel Standard by approximately 10 percent.

[3] Research to help quantify these greenhouse gas emissions reductions is continuing, so only 1 $MMTCO_2E$ of these reductions are currently counted toward the AB 32 goal in this plan. Additional tons will be considered part of the safety margin.

A Balanced and Comprehensive Approach

Meeting the goals of AB 32 will require a coordinated set of strategies to reduce emissions throughout the economy. These strategies will fit within the comprehensive tracking, reporting, and enforcement framework that is already being developed and implemented. By 2020, a hard and declining cap will cover 85 percent of California's greenhouse gas emissions, helping to ensure that we meet our reduction targets on time.

AB 32 lays out a number of important factors that have helped to guide the development of this plan and will continue to be considered as regulations are developed over the next few years. Some of the key criteria that have and will be further considered are: cost-effectiveness; overall societal benefits like energy diversification and public health improvements; minimization of leakage; and impacts on specific sectors like small business and disproportionately impacted communities. The comprehensive approach in the plan reflects a balance among these and other important factors and will help to ensure that California meets its greenhouse gas reduction targets in a way that promotes and rewards innovation, is consistent with and helps to foster economic growth, and delivers improvements to the environment and public health.

Many of the measures in this plan complement and reinforce one another. For instance, the Low Carbon Fuel Standard, which reduces the carbon intensity of transportation fuels sold in California, will work in tandem with technology-forcing regulations designed to reduce greenhouse gas emissions from cars and trucks. Improvements in land use and the ways we grow and build our communities will further reduce emissions from the transportation sector.

Many of the measures also build on highly successful long-standing practices in California—such as energy efficiency and the use of renewable energy resources—that can be accelerated and expanded. Increasing the amount of energy we get from renewable energy sources, including placing solar arrays and solar water heaters on houses throughout California, will be supported by an increase in building standards for energy efficiency. Other measures address the transport and treatment of water throughout the state, reduce greenhouse gas emissions that come from ships in California's ports, and promote changes to agricultural and forestry practices. There are also measures designed to safely reduce or recover a range of very potent greenhouse gases – refrigerants and other industrial gases – that contribute to global warming at a level many times greater per ton emitted than carbon dioxide.

Many of the measures in this plan are designed to take advantage of the economic and innovation-related benefits that market-based compliance strategies can provide. Particularly in light of current economic uncertainty, it is important to ensure that California's climate policies be designed to promote and take advantage of economic opportunities while also cutting greenhouse gas emissions. For instance, the cap-and-trade program creates an opportunity for firms to seek out cost-effective emission reduction strategies and provides an incentive for technological innovation. California's clean car standards, which require manufacturers to meet annual average levels of greenhouse gas emissions for all cars they sell in California, also offer flexibility to help ensure compliance. Under California's clean

car standards, manufacturers who exceed compliance standards are permitted to bank credits for future use or sell them to other manufacturers. These types of compliance options will be key in ensuring that we are able to meet our reduction targets in a cost-effective manner.

Working with the Western Climate Initiative

California is working closely with six other states and four Canadian provinces in the Western Climate Initiative (WCI) to design a regional greenhouse gas emissions reduction program that includes a cap-and-trade approach. California's participation in WCI creates an opportunity to provide substantially greater reductions in greenhouse gas emissions from throughout the region than could be achieved by California alone. The larger scope of the program also expands the market for clean technologies and helps avoid leakage, that is, the shifting of emissions from sources within California to sources outside the state.

The WCI partners released the recommended design for a regional cap-and-trade program in September 2008.[4] ARB embraces the WCI effort, and will continue to work with WCI partners. The creation of a robust regional trading system can complement the other policies and measures included in this plan, and provide the means to achieve the reduction of greenhouse gas emissions needed from a wide range of sectors as cost-effectively as possible.

California's Economy, Environment, and Public Health

The approaches in this plan are designed to maximize the benefits that can accompany the transition to a clean energy economy. California has a long and successful track record of implementing environmental policies that also deliver economic benefits. This plan continues in that tradition.

AB 32: Evaluating the Economic Effects

The economic analysis of this plan indicates that implementation of the recommended strategies to address global warming will create jobs and save individual households money.[5] The analysis also indicates that measures in the plan will position California to move toward a more secure, sustainable future where we invest heavily in energy efficiency and clean technologies. The economic analysis indicates that implementation of that forward-looking approach also creates more jobs and saves individual households more money than if California stood by and pursued an unacceptable course of doing nothing at all to address our unbridled reliance on fossil fuels.

Specifically, analysis of the Scoping Plan indicates that projected economic benefits in 2020 compared to the business-as-usual scenario include:

- Increased economic production of $33 billion

[4] Details of the WCI recommendation are provided in Appendix D.

[5] See Appendix G.

- Increased overall gross state product of $7 billion
- Increased overall personal income by $16 billion
- Increased per capita income of $200
- Increased jobs by more than 100,000

Furthermore, the results of the economic analysis may underestimate the economic benefits of the plan since the models that were used do not account for savings that result from the flexibility provided under market-based programs.

AB 32: The Environmental and Public Health Costs of Inaction

A key factor that was not weighed in the overall economic analysis is the potential cost of doing nothing. When these costs are taken into account, the benefits associated with implementing a comprehensive plan to cut greenhouse gas emissions become even clearer. As a state, California is particularly vulnerable to the costs associated with unmitigated climate change.

A summary report from the California Climate Change Center notes that a warming California climate would generate more smoggy days by contributing to ozone formation while also fostering more large brush and forest fires. Continuing increases in global greenhouse gas emissions at business-as-usual rates would result, by late in the century, in California losing 90 percent of the Sierra snow pack, sea level rising by more than 20 inches, and a three to four times increase in heat wave days. These impacts will translate into real costs for California, including flood damage and flood control costs that could amount to several billion dollars in many regions such as the Central Valley, where urbanization and limited river channel capacity already exacerbate existing flood risks.[6] Water supply costs due to scarcity and increased operating costs would increase as much as $689 million per year by 2050.[7] ARB analysis shows that due to snow pack loss, California's snow sports sector would be reduced by $1.4 billion (2006 dollars) annually by 2050 and shed 14,500 jobs; many other sectors of California's economy would suffer as well.

Failing to address climate change also carries with it the risk of substantial public health costs, primarily as a result of rising temperatures. Sustained triple-digit heat waves increase the health risk for several segments of the population, especially the elderly. But higher average temperatures will also increase the interactions of smog-causing chemicals with sunlight and the atmosphere to produce higher volumes of toxic byproducts than would otherwise occur. In the 2006 report to the Governor

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[6] A Summary Report from: California Climate Change Center. *Our Changing Climate: Assessing the Risks to California*. Document No. CEC-500-2006-077. July 2006. http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF (accessed October 12, 2008)

[7] A Report from: California Climate Change Center. *Climate Warming and Water Supply Management in California*. Document No. CEC-500-2005-195-SF. March 2006. pp.13-14 http://www.energy.ca.gov/2005publications/CEC-500-2005-195/CEC-500-2005-195-SF.PDF (accessed October 12, 2008).

from the California Climate Center, it was reported that global increases in temperature will lead to increased concentrations and emissions of harmful pollutants in California.[8] Some cities in California are disproportionately susceptible to temperature increases since they already have elevated pollution levels and are subject to the heat-island effect that reduces nighttime cooling, allowing heat to build up and magnify the creation of additional harmful pollution. Low-income communities are disproportionately impacted by climate change, lacking the resources to avoid or adapt to these impacts. For example, low-income residents are less likely to have access to air conditioning to prevent heat stroke and death in heat waves. For California, then, taking action with other regions and nations to help mitigate the impacts of climate change will help slow temperature rise. This in turn will likely result in fewer premature deaths from respiratory and heat-related causes, and many thousands fewer hospital visits and days of illness.

California cannot avert the impacts of global climate change by acting alone. We can, however, take a national and international leadership role in this effort by demonstrating that taking firm and reasoned steps to address global warming can actually help spur economic growth.

AB 32: Providing Savings for Households and Businesses

This plan builds upon California's thirty-year track record of pioneering energy efficiency programs. Many of the measures in the plan will deliver significant gains in energy efficiency throughout the economy. These gains, even after increases in per unit energy costs are taken into account, will help deliver annual savings of between $400 and $500 on average by 2020 for households, including low-income households.

Businesses, both large and small, will benefit too. By 2020, the efficiency measures in the plan will decrease overall energy expenditures for businesses even after taking into account projected rises in per unit energy costs. Since small businesses spend a greater proportional share of revenue on energy-related costs, they are likely to benefit the most. Furthermore, businesses throughout the state will benefit from the overall economic growth that is projected to accompany implementation of AB 32 between now and 2020.

Similar savings are projected in the transportation sector. By reducing greenhouse gas pollution from more efficient and alternatively-fueled cars and trucks under California's Clean Car law (the Pavley greenhouse gas standards), consumers save on operating costs through reduced fuel use. Although cars will be marginally more expensive, owners will be paid back with savings over the lifetime of the car, and the average new car buyer will have an extra $30 each month for other expenditures. Current estimates indicate that consumer savings in 2020 for California's existing

[8] A Report from: California Climate Change Center. *Scenarios of Climate Change in California: An Overview*. Document No. CEC-500-2005-186-SF. February 2006. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF (accessed October 12, 2008)

clean car standards will be over $12 billion. These savings give Californians the ability to invest their dollars in other sectors of the state's economy.

AB 32: Driving Investment and Job Growth

Addressing climate change also provides a strong incentive for investment in California. Our leadership in environmental and energy efficiency policy has already helped attract a large and growing share of the nation's venture capital investment in green technologies. Since AB 32 was signed into law, venture capital investment in California has skyrocketed. In the second quarter of 2008 alone, California dominated world investment in clean technology venture capital, receiving $800 million of the global total of $2 billion.[9]

These investments in building a new clean tech sector also translate directly into job growth. A study by U.C. Berkeley's Energy and Resources Group and Goldman School of Public Policy found that investments in green technologies produce jobs at a higher rate than investments in comparable conventional technologies.[10] And the National Venture Capital Association estimates that each $100 million in venture capital funding helps create 2,700 jobs, $500 million in annual revenues for two decades and many indirect jobs.[11]

AB 32: Improving Public Health

The public health analysis conducted for this Plan indicates that cutting greenhouse gases will also provide a wide range of additional public health and environmental benefits. By 2020, the economic value alone of the additional air-quality related benefits is projected to be on the order of $4.4 billion. Our analysis indicates that implementing the Scoping Plan will result in a reduction of 15 tons per day of combustion-generated soot (PM 2.5) and 61 tons per day of oxides of nitrogen (precursors to smog). These reductions in harmful air pollution would provide the following estimated health benefits in 2020, above and beyond those projected to be achieved as a result of California's other existing public health protection and improvement efforts:

- An estimated 780 premature deaths statewide will be avoided
- Almost 12,000 incidences of asthma and lower respiratory symptoms will be avoided

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[9] Press Release from Cleantech Network LLC, *Cleantech Venture Investment Reaches Record of $2 Billion in 2008*. July 08, 2008. http://cleantech.com/about/pressreleases/011008.cfm (accessed October 12, 2008)

[10] Report of the Renewable and Appropriate Energy Laboratory. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[11] Report prepared for the National Venture Capital Association. *Venture Impact 2004: Venture Capital Benefits to the U.S. Economy*. Prepared by: Global Insight. June 2004. http://www.globalinsight.com/publicDownload/genericContent/07-20-04_fullstudy.pdf (accessed October 12, 2008)

- 77,000 work loss days will be avoided

In addition to the quantified health benefits, our analysis also indicates that implementation of the measures in the plan will deliver a range of other public health benefits. These include health benefits associated with local and regional transportation-related greenhouse gas targets that will facilitate greater use of alternative modes of transportation such as walking and bicycling. These types of moderate physical activities reduce many serious health risks including coronary heart disease, diabetes, hypertension and obesity.[12] Furthermore, as specific measures are developed, ARB and public health experts will work together to ensure that they are designed with an eye toward capturing a broad range of public health co-benefits.

The results of both the economic and public health analyses are clear: guiding California toward a clean energy future with reduced dependence on fossil fuels will grow our economy, improve public health, protect the environment and create a more secure future built on clean and sustainable technologies.

State Leadership

California is committed to once again lead and support a pioneering effort to protect the environment and improve public health while maintaining a vibrant economy. Every agency, department and division will bring climate change considerations into its policies, planning and analysis, building and expanding current efforts to green its fleet and buildings, and managing its water, natural resources, and infrastructure to reduce greenhouse gas emissions.

In all these efforts, California is exercising a leadership role in global action to address climate change. It is also exemplifying the essential role states play as the laboratories of innovation for the nation. As California has done in the past in addressing emissions that caused smog, the State will continue to develop innovative programs that benefit public health and improve our environment and quality of life.

Moving Beyond 2020

AB 32 requires a return to 1990 emission levels by 2020. The Scoping Plan is designed to achieve that goal. However, 2020 is by no means the end of California's journey to a clean energy future. In fact, that is when many of the strategies laid out in this plan will just be kicking into high gear.

Take, for example, the regional transportation-related greenhouse gas emissions targets. In order to achieve the deep cuts in greenhouse gas emissions we will need beyond 2020 it will be necessary to significantly change California's current land use and transportation planning policies. Although these changes will take time, getting started now will help put California

[12] Appendix H contains a reference list of studies documenting the public health benefits of alternative transportation.

on course to cut statewide greenhouse gas emissions by 80 percent in 2050 as called for by Governor Schwarzenegger.

Similarly, measures like the cap-and-trade program, energy efficiency programs, the California clean car standards, and the renewables portfolio standard will all play central roles in helping California meet its 2020 reduction requirements. Yet, these strategies will also figure prominently in California's efforts beyond 2020. Some of these measures, like energy efficiency programs and the renewables portfolio standard, have already delivered greenhouse gas emissions reduction benefits that will expand over time. Others, like the cap-and-trade program, will put in place a foundation on which to build well into the future. All of these measures, and many others in the plan, will ensure that California meets its 2020 target and is positioned to continue its international role as leader in the fight against global warming to 2050 and beyond.

A Shared Challenge

Californians are already responding to the challenge of reducing greenhouse gas emissions. Over 120 California cities and counties have signed on to the U.S. Conference of Mayors Climate Protection Agreement[13] and many have established offices of climate change and are developing comprehensive plans to reduce their carbon footprint. Well over 300 companies, municipalities, organizations and corporations are members of the California Climate Action Registry, reporting their greenhouse gas emissions on an annual basis. Many other businesses and corporations are making climate change part of their fiscal and strategic planning. ARB encourages these initial efforts and has set in place a policy to support and encourage other voluntary early reductions.

Successful implementation of AB 32 will depend on a growing commitment by a majority of companies to include climate change as an integral part of their planning and operations. Individuals and households throughout the state will also have to take steps to consider climate change at home, at work and in their recreational activities. To support this effort, this plan includes a comprehensive statewide outreach program to provide businesses and individuals with the widest range of information so they can make informed decisions about reducing their carbon footprints.

Californians will not have to wait for decades to see the benefits of a low carbon economy. New homes can achieve a near zero-carbon footprint with better building techniques and existing technologies, such as solar arrays and solar water heaters. Many older homes can be retrofitted to use far less energy than at present. A new generation of vehicles, including plug-in hybrids, is poised to appear in dealers' showrooms, and the development of the infrastructure to support hydrogen fuel cell cars continues. Cities and new developments will be more walkable, public transport will improve, and high-speed rail will give travelers a new clean transportation option.

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[13] Mayors Climate Protection Center. *List of Participating Mayors.* http://www.usmayors.org/climateprotection/list.asp (accessed October 12, 2008)

That world is just around the corner. What lies beyond is even more exciting. Where will California be in 2050? By harnessing the ingenuity and creativity of our society and sparking the imagination of the next generation of Californians, California will make the transition to a clean-energy, low-carbon society and become a healthier, cleaner and more sustainable place to live. This plan charts a course toward that future.

ARB invites comment and input from the broadest array of the public and stakeholders as we move forward over the next two years to develop the individual measures, and develop the policies that will move us toward sustainable clean energy and away from fossil fuels. Your participation will help craft the mechanisms and measures to make this plan a reality. This is California's plan and together, we need to make the necessary changes to address the greatest environmental challenge we face. As Governor Schwarzenegger stated when he signed AB 32 into law two years ago, "We owe our children and we owe our grandchildren. We simply must do everything in our power to fight global warming before it is too late."

I. INTRODUCTION: A Framework for Change

California strengthened its commitment to address climate change when Governor Schwarzenegger signed Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). This groundbreaking legislation represents a turning point for California and makes it clear that a business-as-usual approach toward greenhouse gas emissions is no longer acceptable. In light of the need for strong and immediate action to counter the growing threat of global warming, AB 32 sets forth an aggressive timetable for achieving results.

AB 32 embodies the idea that California can continue to grow and flourish while reducing its greenhouse gas emissions and continuing its long-standing efforts to achieve healthy air, and protect and enhance public health. Achieving these goals will involve every sector of the state's $1.7 trillion economy and touch the life of every Californian.

As the lead agency for implementing AB 32, the California Air Resources Board (ARB or the Board) released a Draft Scoping Plan on June 26, 2008, which laid out a comprehensive statewide plan to reduce California's greenhouse gas emissions to 1990 levels by 2020. This draft plan set forth a comprehensive reduction strategy that combines market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs that will significantly reduce emissions of greenhouse gases and help make our state cleaner, more efficient and more secure.

Based upon the numerous comments received on the draft, as well as additional staff analysis, ARB released a *Proposed* Scoping Plan on October 15, 2008. At its November 20 and 21, 2008 meeting, the Board heard staff presentations on the Proposed Scoping Plan and directed staff to make a number of modifications. This *Approved* Scoping Plan incorporates these modifications, as well as corrections from the November 14, 2008 errata sheet, but otherwise reflects the same measures of the Proposed Scoping Plan.

The Board approved this Scoping Plan at its December 11, 2008 meeting, providing specific direction for the State's greenhouse gas emissions reduction program. The recommended measures will be developed into regulations over the next two years, to go into effect by January 1, 2012. As specific measures in the plan are developed, we will update and adjust our regulatory proposals as necessary to ensure that they reflect any new information, additional analyses, new technologies or other factors that emerge during the process.

ARB has conducted a transparent, wide-ranging public process to develop the Scoping Plan, including numerous meetings, workshops, and seminars with stakeholders. Substantial input on the development of the Scoping Plan came from formal advisory committees, meetings with industrial and business groups, non-profit organizations and members of the public, as

well as written comments on the Draft Scoping Plan. ARB will continue its outreach activities to seek ongoing public input and will encourage early and continued involvement in the implementation of the plan from all Californians.

A. Summary of Changes from the Draft Scoping Plan

ARB released the June Draft Scoping Plan and requested public comment and input, while continuing to analyze the measures and their impact on California. Since the Draft Scoping Plan release, ARB received almost 1,000 unique written comments as well as hundreds of verbal comments at workshops and in meetings. Taking into account that some written comments were submitted by multiple individuals, all told more than 42,000 people have commented on the draft plan. ARB has also completed detailed economic and public health evaluations of its recommendations.

The key changes between the Draft Scoping Plan and the Scoping Plan are summarized below. The Scoping Plan includes the following modifications:

1. General

- Incorporates economic and public health analyses of the Scoping Plan. These analyses show that the recommendations in the Scoping Plan will have a net positive impact on both the economy and public health. These analyses follow the same methodology used to evaluate the Draft Scoping Plan.
- Provides a "margin of safety" by recommending additional greenhouse gas emissions reduction strategies to account for measures in uncapped sectors that do not achieve the greenhouse gas emissions reductions estimated in the Scoping Plan. Along with the certainty provided by the cap, this will ensure that the 2020 target is met.
- Expands the discussion of workforce development, education, and labor to more fully reflect existing activities and the role of other state agencies in ensuring an adequate green technology workforce.
- Assesses how well the recommended measures put California on the long-term reduction trajectory needed to do our part to stabilize the global climate.
- Describes California's role in the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon capture and sequestration opportunities, and expresses support for near-term advancement of the technology and monitoring of its development. Acknowledges the important role of terrestrial sequestration.
- Provides greater detail on the mechanisms to be developed to encourage voluntary early action.
- Provides additional detail on implementation, tracking and enforcement of the recommended actions, including the important role of local air districts.

- Evaluates the potential environmental impacts of the Scoping Plan under the California Environmental Quality Act (CEQA). This evaluation is contained in Appendix J.

2. Proposed Measures

- Provides greater detail on the proposed cap-and-trade program including more detail on the allocation and auction of allowances, and clarification of the proposed role of offsets.
- Re-evaluates the potential benefits from regional targets for transportation-related greenhouse gases in consultation with regional planning organizations and researchers at U.C. Berkeley. Based on this information, ARB increased the anticipated greenhouse gas emissions reductions for Regional Transportation-Related Greenhouse Gas Targets from 2 to 5 million metric tons of CO_2 equivalent ($MMTCO_2E$).
- In recognition of the importance of local governments in the successful implementation of AB 32, adds a section describing this role and recommends a greenhouse gas emissions reduction target for local government municipal and community-wide emissions of a 15 percent reduction from current levels by 2020 to parallel the State's target.
- Adds four measures to address emissions from industrial sources. These proposed measures would regulate fugitive emissions from oil and gas recovery and gas transmission activities, reduce refinery flaring, and remove the methane exemption for refineries. These proposed measures are anticipated to provide 1.5 $MMTCO_2E$ of greenhouse gas reductions in 2020.
- In consultation with the California Integrated Waste Management Board, re-assesses potential measures in the Recycling and Waste sector. As a result of this assessment, ARB increased the reduction of greenhouse gas emissions that can ultimately be anticipated from the Recycling and Waste Sector from 1 to 10 $MMTCO_2E$, recommending measures to move toward high recycling and zero-waste. Research to help quantify these greenhouse gas emissions is continuing, so only 1 $MMTCO_2E$ of these reductions is currently counted towards the AB 32 goal in this plan.
- Estimates the potential reduction of greenhouse gas emissions from the Green Building sector. Green building systems have the potential to reduce approximately 26 $MMTCO_2E$ of greenhouse gas emissions. Since most of these emissions reductions are counted in the Electricity, Commercial/Residential Energy, Water or Waste sectors, emission reductions in the Green Building sector are not separately counted toward the AB 32 goal.
- Adds a High Global Warming Potential (GWP) Mitigation Fee measure to ensure that the climate impact of these gases is reflected in their price to encourage reduced use and end-of-life losses, as well as the development of alternatives.
- Reduces the expected greenhouse gas emissions reduction from the Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) measure and the Tire Inflation measure based on ongoing regulatory

development. The Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) measure is now expected to achieve 0.9 $MMTCO_2E$ and the Tire Inflation measure is now expected to achieve 0.4 $MMTCO_2E$.

- Modifies the expected reduction of greenhouse gas emissions from the Low Carbon Fuel Standard to account for potential overlap of benefits with the Pavley greenhouse gas vehicle standards. ARB discounted the expected emission reductions from the Low Carbon Fuel Standard by 10 percent.
- After further evaluation, moves the Heavy-Duty Truck Efficiency measure to the Goods Movement measure. ARB expects that market dynamics will provide an inducement to improve heavy-duty truck efficiency, and reductions in greenhouse gases in the future. ARB would consider pursuing direct requirements to reduce greenhouse gases if truck efficiency does not improve in the future.

B. Background

1. Climate Change Policy in California

California first addressed climate change in 1988 with the passage of AB 4420 (Sher, Chapter 1506, Statutes of 1988). This bill directed the California Energy Commission (CEC) to study global warming impacts to the state and develop an inventory of greenhouse gas emissions sources. In 2000, SB 1771 (Sher, Chapter 1018, Statutes of 2000) established the California Climate Action Registry to allow companies, cities and government agencies to voluntarily record their greenhouse gas emissions in anticipation of a possible program that would allow them to be credited for early reductions.

In 2001, the United Nations' Intergovernmental Panel on Climate Change (IPCC) reported that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." The following year, AB 1493 (Pavley, Chapter 200, Statutes of 2002) was signed into law, requiring ARB to develop regulations to reduce greenhouse gas emissions from passenger vehicles, light-duty trucks and non-commercial vehicles sold in California.

Recognizing the value of regional partners in addressing climate change, the governors of California, Washington, and Oregon created the West Coast Global Warming Initiative in 2003 with provisions for the states to work together on climate change-related programs.

Two years later Governor Schwarzenegger signed Executive Order S-3-05, calling for the State to reduce greenhouse gas emissions to 1990 levels by 2020 and to reduce greenhouse gas emissions to 80 percent below 1990 levels by 2050. The 2020 goal was established to be an aggressive, but achievable, mid-term target, and the 2050 greenhouse gas emissions reduction goal represents the level scientists believe is necessary to reach levels that will stabilize climate.

In 2006, SB 1368 (Perata, Chapter 598, Statutes of 2006) created greenhouse gas performance standards for new long-term financial investments in base-load electricity generation serving California customers. This law is designed to help spur the transition toward cleaner energy in California by placing restrictions on the ability of utilities to build new carbon-intensive plants or enter into new contracts with high carbon sources of electricity. Expiration of existing utility long-term contracts with coal plants will reduce greenhouse gas emissions when such generation is replaced by lower greenhouse gas-emitting resources. These reductions will reduce the need for utilities to submit allowances to comply with the cap-and-trade program.

2. Assembly Bill 32: The Global Warming Solutions Act

In 2006, the Legislature passed and Governor Schwarzenegger signed AB 32, the Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. It directed ARB to begin developing discrete early actions to reduce greenhouse gases while also preparing a Scoping Plan to identify how best to reach the 2020 limit. The reduction measures to meet the 2020 target are to become operative by 2012.

AB 32 includes a number of specific requirements for ARB:

- *Identify the statewide level of greenhouse gas emissions in 1990 to serve as the emissions limit to be achieved by 2020 (Health and Safety Code (HSC) §38550).* In December 2007, the Board approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent ($MMTCO_2E$) of greenhouse gases.
- *Adopt a regulation requiring the mandatory reporting of greenhouse gas emissions (HSC §38530).* In December 2007, the Board adopted a regulation requiring the largest industrial sources to report and verify their greenhouse gas emissions. The reporting regulation serves as a solid foundation to determine greenhouse gas emissions and track future changes in emission levels.
- *Identify and adopt regulations for Discrete Early Actions that could be enforceable on or before January 1, 2010 (HSC §38560.5).* The Board identified nine Discrete Early Action measures including potential regulations affecting landfills, motor vehicle fuels, refrigerants in cars, port operations and other sources in 2007. The Board has already approved two Discrete Early Action measures (ship electrification at ports and reduction of high GWP gases in consumer products). Regulatory development for the remaining measures is ongoing.
- *Ensure early voluntary reductions receive appropriate credit in the implementation of AB 32 (HSC §38562(b)(3)).* In February 2008, the Board approved a policy statement encouraging voluntary early actions and establishing a procedure for project proponents to submit quantification methods to be evaluated by ARB. ARB, along with California's local air districts and the California Climate Action Registry, is working to implement this program. Voluntary programs are discussed further in Chapter II and in Chapter IV.

- *Convene an Environmental Justice Advisory Committee (EJAC) to advise the Board in developing the Scoping Plan and any other pertinent matter in implementing AB 32 (HSC §38591).* The EJAC has met 12 times since early 2007, providing comments on the proposed Early Action measures and the development of the Scoping Plan, and submitted its comments and recommendations on the draft Scoping Plan in October 2008. ARB will continue to work with The EJAC as AB 32 is implemented.
- *Appoint an Economic and Technology Advancement Advisory Committee (ETAAC) to provide recommendations for technologies, research and greenhouse gas emission reduction measures (HSC §38591).* After a year-long public process, The ETAAC submitted a report of their recommendations to the Board in February 2008. The ETAAC also reviewed and provided comments on the Draft Scoping Plan.

3. Climate Action Team

In addition to establishing greenhouse gas emissions reduction targets for California, Executive Order S-3-05 established the Climate Action Team (CAT) for State agencies in 2005. Chaired by the Secretary of the California Environmental Protection Agency (CalEPA), the CAT has helped to direct State efforts on the reduction of greenhouse gas emissions and engage key State agencies including ARB. The Health and Human Services Agency, represented by the Department of Public Health, is the newest member of the CAT. Based on numerous public meetings and the review of thousands of submitted comments, the CAT released its first report in March 2006, identifying key carbon reduction recommendations for the Governor and Legislature.

Climate Action Team

California Environmental Protection Agency
Business, Transportation, and Housing Agency
Health and Human Services Agency
Resources Agency
State and Consumer Services Agency
Governor's Office of Planning and Research
Air Resources Board
California Energy Commission
California Public Utilities Commission
Department of Food and Agriculture
Department of Forestry and Fire Protection
Department of General Services
Department of Parks and Recreation
Department of Transportation
Department of Water Resources
Integrated Waste Management Board
State Water Resources Control Board

In April 2007, the CAT released a second report, "Proposed Early Actions to Mitigate Climate Change in California," which details numerous strategies that should be initiated prior to the 2012 deadline for other climate action regulations and efforts.

AB 32 recognizes the essential role of the CAT in coordinating overall climate policy. AB 32 does not affect the existing authority of other state agencies, and in addition to

ARB, many state agencies will be responsible for implementing the measures and strategies in this plan. The CAT is central to the success of AB 32, which requires an unprecedented level of cooperation and coordination across State government. The CAT provides the leadership for these efforts and helps ARB work closely with our state partners on the development and implementation of the strategies in the Scoping Plan.

There are currently 12 subgroups within the CAT – nine that address specific economic sectors, and three that were formed to analyze broad issues related to implementing a multi-sector approach to greenhouse gas emissions reduction efforts. The CAT sector-based subgroups include: Agriculture, Cement, Energy, Forest, Green Buildings, Land Use, Recycling and Waste Management, State Fleet, and Water-Energy. The members of these subgroups are drawn from departments that work with or regulate industries in the sector. ARB participated in each of the subgroups. All of the subgroups held public meetings and solicited public input, and many had multiple public workshops.

In March 2008, the subgroups collectively submitted more than 100 greenhouse gas emissions reduction measures to ARB for consideration in the Draft Scoping Plan. Many of those recommendations are reflected in this plan, and a number of them focus on reducing greenhouse gas emissions from energy production and use.

Through the Energy Subgroup the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) are conducting a joint proceeding to provide recommendations on how best to address electricity and natural gas in the implementation of AB 32, including evaluation of how the Electricity sector might best participate in a cap-and-trade program. The two Commissions forwarded interim recommendations to ARB in March 2008 that supported inclusion of the Electricity sector in a multi-sector cap-and-trade program, and measures to increase the penetration of energy efficiency programs in both buildings and appliances and to increase renewable energy sources. The two Commissions have developed a second proposed decision that was released in September 2008. This proposed decision provides more detailed recommendations that relate to the electricity and natural gas sectors. Because implementation of the Scoping Plan will require careful coordination with the State's energy policy, ARB will continue working closely with the two Commissions on this important area during the implementation of the recommendations in the Scoping Plan.

There are also three subgroups which are not sector-specific. The Economic Subgroup reviewed cost information associated with potential measures that were included in the 2006 CAT report with updates reflected in the report, "Updated Macroeconomic Analysis of Climate Strategies," in October 2007. This report provided an update of the macroeconomic analysis presented in the March 2006 CAT report to Governor Schwarzenegger and the Legislature. The Research Subgroup coordinates climate change research and identifies opportunities for collaboration, and is presently working on a report to the Governor. The State Operations Subgroup

has been created to work with State agencies to create a statewide plan to reduce State government's greenhouse gas emissions by a minimum of 30 percent by 2020.

In the first quarter of 2009, the Climate Action Team will release a report on its activities outside of its involvement in the development of the Scoping Plan. The CAT report will focus on several cross-cutting topics with which members of the CAT have been involved since the publication of the 2006 CAT report. The topics to be covered include research on the physical and consequent economic impacts of climate change as well as climate change research coordination efforts among the CAT members. There will also be an update on the important climate change adaptation efforts led by the Resources Agency and a discussion of cross-cutting issues related to environmental justice concerns. The CAT report will be released in draft form and will be available for public review in December 2008.

4. Development of the Greenhouse Gas Emission Reduction Strategy

In developing the Scoping Plan, ARB considered the State's existing climate change policy initiatives and the Early Action measures identified by the Board. Several advisory groups were formed to assist ARB in developing the Scoping Plan, including the Environmental Justice Advisory Committee (EJAC), the Economic and Technology Advancement Committee (ETAAC), and the Market Advisory Committee (MAC).

The Environmental Justice Advisory Committee (HSC §38591(a) et seq) advises ARB on development of the Scoping Plan and any other pertinent matter in implementing AB 32. The Board appoints its members, based on nominations received from environmental justice organizations and community groups.

The Economic and Technology Advancement Advisory Committee (HSC §38591(d)) includes members who are appointed by the Board based on expertise in fields of business, technology research and development, climate change, and economics. The ETAAC advises ARB on activities that will facilitate investment in, and implementation of, technological research and development opportunities, funding opportunities, partnership development, technology transfer opportunities, and related areas that lead to reductions of greenhouse gas emissions.

Members of the Market Advisory Committee (created under Executive Order S-20-06) were appointed by the Secretary of CalEPA based on their expertise in economics and climate change. The MAC advised ARB on the design of a cap-and-trade program for reducing greenhouse gas emissions.

Along with input from the advisory groups, ARB received submittals to a public solicitation for ideas, and numerous comments during public workshops, workgroup meetings, community meetings, and meetings with stakeholder groups. ARB held numerous workshops on the Draft Scoping Plan and convened workgroup meetings focused on program design and economic analysis. ARB and other involved State

agencies also held sector-specific technical workshops to look in greater detail at potential emissions reduction measures.

ARB also looked outward to examine programs at the regional, national and international levels. ARB met with and learned from experts from the European Union, the United Kingdom, Japan, Australia, the United Nations, the Regional Greenhouse Gas Initiative, the RECLAIM program, and the U.S. Environmental Protection Agency (U.S. EPA).

After the release of the Draft Scoping Plan, ARB conducted workshops and community meetings around the state to solicit public input. The Environmental Justice Advisory Committee and the Economic and Technology Advancement Advisory Committee held meetings to review and provide additional comments on the Draft Scoping Plan. In addition, ARB held meetings with numerous stakeholder groups to discuss specific greenhouse gas emissions reduction measures.

As described before, ARB has reviewed and considered both the written comments and the verbal comments received at the public workshops and meetings with stakeholders. This input, along with additional analysis, has ultimately shaped this Scoping Plan.

5. Implementation of the Scoping Plan

The foundation of the Scoping Plan's strategy is a set of measures that will cut greenhouse gas emissions by nearly 30 percent by the year 2020 as compared to business as usual and put California on a course for much deeper reductions in the long term. In addition to pursuing the reduction of greenhouse gas emissions, other strategies to mitigate climate change, such as carbon capture and storage (underground geologic storage of carbon dioxide), should also be further explored. And, as greenhouse gas reduction measures are implemented, we will continually evaluate how these measures can be optimized to also help deliver a broad range of public health benefits.

Most of the measures in this Scoping Plan will be implemented through the full rulemaking processes at ARB or other agencies. These processes will provide opportunity for public input as the measures are developed and analyzed in more detail. This additional analysis and public input will likely provide greater certainty about the estimates of costs and expected greenhouse gas emission reductions, as well as the design details that are described in this Scoping Plan. With the exception of Discrete Early Actions, which will be in place by January 1, 2010, other regulations are expected to be adopted by January 1, 2011 and take effect at the beginning of 2012.

Some of the measures in the plan may deliver more emission reductions than we expect; others less. It is also very likely that we will figure out new and better ways to cut greenhouse gas emissions as we move forward. New technologies will no doubt be developed, and new ideas and strategies will emerge. The Scoping Plan puts

California squarely on the path to a clean energy future but it also recognizes that adjustments will probably need to occur along the way and that as additional tools become available they will augment, and in some cases perhaps even replace, existing approaches.

California will not be implementing the measures in this Plan in a vacuum. Significant new action on climate policy is likely at the federal level and California and its partners in the Western Climate Initiative are working together to create a regional effort for achieving significant reductions of greenhouse gas emissions throughout the western United States and Canada. California is also developing a state Climate Adaptation Strategy to reduce California's vulnerability to known and projected climate change impacts.

ARB and other State agencies will continue to monitor, lead and participate in these broader activities. ARB will adjust the measures described here as necessary to ensure that California's program is designed to facilitate the development of integrated and cost-effective regional, national, and international greenhouse gas emissions reduction programs. (HSC §38564)

6. Climate Change in California

The impacts of climate change on California and its residents are occurring now. Of greater concern are the expected future impacts to the state's environment, public health and economy, justifying the need to sharply cut greenhouse gas emissions.

In the Findings and Declarations for AB 32, the Legislature found that:

> "The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to the marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other health-related problems."

The Legislature further found that global warming would cause detrimental effects to some of the state's largest industries, including agriculture, winemaking, tourism, skiing, commercial and recreational fishing, forestry, and the adequacy of electrical power.

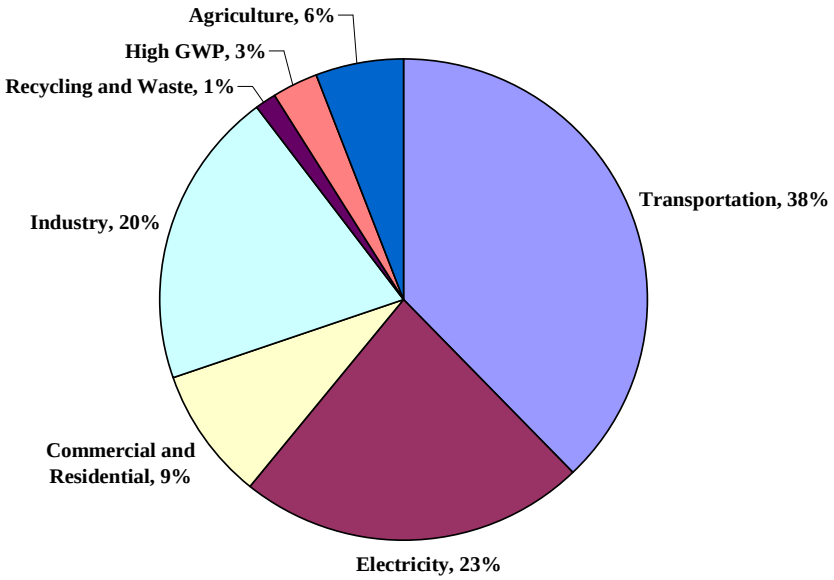
The impacts of global warming are already being felt in California. The Sierra snowpack, an important source of water supply for the state, has shrunk 10 percent in the last 100 years. It is expected to continue to decrease by as much as 25 percent by 2050. World-wide changes are causing sea levels to rise – about 8 inches of increase has been recorded at the Golden Gate Bridge over the past 100 years – threatening low coastal areas with inundation and serious damage from storms.

C. California's Greenhouse Gas Emissions and the 2020 Target

California is the fifteenth largest emitter of greenhouse gases on the planet, representing about two percent of the worldwide emissions. Although carbon dioxide is the largest contributor to climate change, AB 32 also references five other greenhouse gases: methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Many other gases contribute to climate change and would also be addressed by measures in this Scoping Plan.

Figure 1 and Table 1 show 2002 to 2004 average emissions and estimates for projected emissions in 2020 without any greenhouse gas reduction measures (business-as-usual case). The 2020 business-as-usual forecast does not take any credit for reductions from measures included in this Plan, including the Pavley greenhouse gas emissions standards for vehicles, full implementation of the Renewables Portfolio Standard beyond current levels of renewable energy, or the solar measures. Additional information about the assumptions in the 2020 forecast is provided in Appendix F.

Figure 1: California's Greenhouse Gas Emissions (2002-2004 Average)[14]



As seen in Figure 1, the Transportation sector – largely the cars and trucks that move goods and people – is the largest contributor with 38 percent of the state's total greenhouse gas emissions. Table 1 shows that if we take no action, greenhouse gas emissions in the

[14] Air Resources Board. Greenhouse Gas Inventory. http://www.arb.ca.gov/cc/inventory/inventory.htm (accessed October 12, 2008)

Transportation sector are expected to grow by approximately 25 percent by 2020 (an increase of 46 $MMTCO_2E$).

The Electricity and Commercial/Residential Energy sector is the next largest contributor with over 30 percent of the statewide greenhouse gas emissions. Although electricity imported into California accounts for only about a quarter of our electricity, imports contribute more than half of the greenhouse gas emissions from electricity because much of the imported electricity is generated at coal-fired power plants. AB 32 specifically requires ARB to address emissions from electricity sources both inside and outside of the state.

California's Industrial sector includes refineries, cement plants, oil and gas production, food processors, and other large industrial sources. This sector contributes almost 20 percent of California's greenhouse gas emissions, but the sector's emissions are not projected to grow significantly in the future. The sector termed recycling and waste management is a unique system, encompassing not just emissions from waste facilities but also the emissions associated with the production, distribution and disposal of products throughout the economy.

Although high global warming potential (GWP) gases are a small contributor to historic greenhouse gas emissions, levels of these gases are projected to increase sharply over the next several decades, making them a significant source by 2020.

The Forest sector is unique in that forests both emit greenhouse gases and uptake carbon dioxide (CO_2). While the current inventory shows forests as a sink of 4.7 $MMTCO_2E$, carbon sequestration has declined since 1990. For this reason, the 2020 projection assumes no net emissions from forests.

The agricultural greenhouse gas emissions shown are largely methane emissions from livestock, both from the animals and their waste. Emissions of greenhouse gases from fertilizer application are also important contributors from the Agricultural sector. ARB has begun a research program to better understand the variables affecting these emissions. Opportunities to sequester CO_2 in the Agricultural sector may also exist; however, additional research is needed to identify and quantify potential sequestration benefits.

In December 2007, ARB approved a greenhouse gas emissions target for 2020 equivalent to the state's calculated greenhouse gas emissions level in 1990. ARB developed the 2020 target after extensive technical work and a series of stakeholder meetings. The 2020 target of 427 $MMTCO_2E$ requires the reduction of 169 $MMTCO_2E$, or approximately 30 percent, from the state's projected 2020 emissions of 596 $MMTCO_2E$ (business-as-usual) and the reduction of 42 $MMTCO_2E$, or almost 10 percent, from 2002-2004 average emissions.

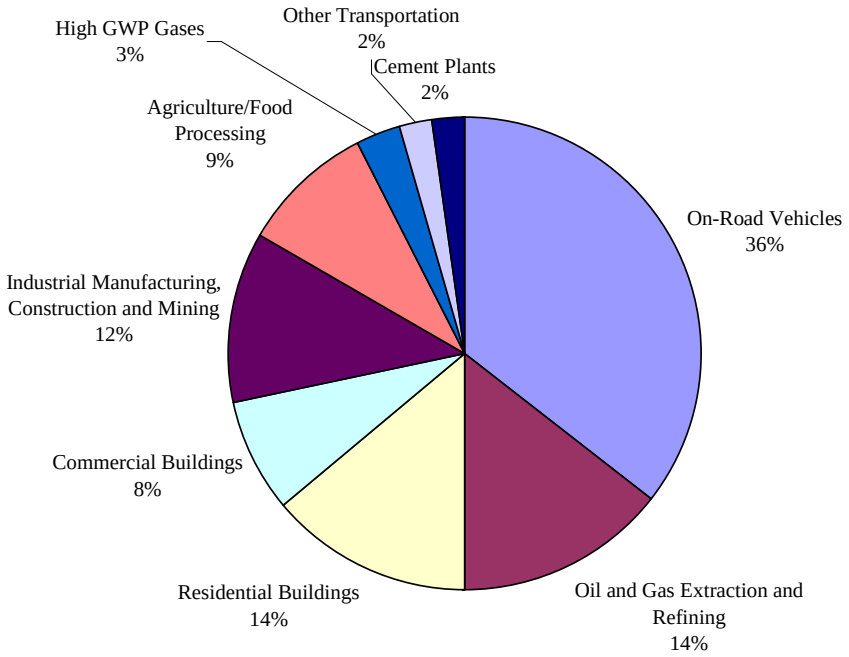
Table 1: 2002-2004 Average Emissions and 2020 Projected Emissions (Business-as-Usual)[15]

($MMTCO_2E$)

Sector	2002-2004 Average Emissions	Projected 2020 Emissions [BAU]
Transportation	179.3	225.4
Electricity	109.0	139.2
Commercial and Residential	41.0	46.7
Industry	95.9	100.5
Recycling and Waste	5.6	7.7
High GWP	14.8	46.9
Agriculture	27.7	29.8
Forest Net Emissions	-4.7	0.0
Emissions Total	**469**	**596**

Figure 2 presents California's historic greenhouse gas emissions in a different way – based not on the source of the emissions, but on the end use. This chart highlights the importance of addressing on-road transportation sources of greenhouse gas emissions, as well as the significant contribution from the heating, cooling, and lighting of buildings.

Figure 2: California's Greenhouse Gas Emissions – A Demand-Side View –



[15] Ibid.

The data shown in this section provide two ways to look at California's greenhouse gas profile – emissions-based and end use (demand side)-based. While it is possible to illustrate the inventory many different ways, no chart or graph can fully display how diverse economic sectors fit together. California's economy is a web of activity where seemingly independent sectors and subsectors operate interdependently and often synergistically. For example, reductions in water use reduce the need to pump water, directly lowering electricity use and associated greenhouse gas emissions. Similarly, reducing the generation of waste reduces the need to transport the waste to landfills – lowering transportation emissions and, possibly, landfill methane emissions. Increased recycling or re-use reduces the carbon emissions embedded in products – it takes less energy to make a soda can made from recycled aluminum than from virgin feedstock.

The measures included in this Scoping Plan are identified discretely, but many impact each other, and changes in one measure can directly overlap and have a ripple effect on the efficacy and success of other measures. The measures and policies outlined in this Plan reflect these interconnections, and highlight the need for all agencies to work collaboratively to implement the Scoping Plan.

II. RECOMMENDED ACTIONS

Achieving the goals of AB 32 in a cost-effective manner will require a wide range of approaches. Every part of California's economy needs to play a role in reducing greenhouse gas emissions. ARB's comprehensive greenhouse gas emissions inventory lists emission sources ranging from the largest refineries and power plants to small industrial processes and farm livestock. The recommended measures were developed to reduce greenhouse gas emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving our natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put the state on a path to meet the long-term 2050 goal of reducing California's greenhouse gas emissions to 80 percent below 1990 levels. This trajectory is consistent with the reductions that are needed globally to help stabilize the climate. While the scale of this effort is considerable, our experience with cultural and technological changes makes California well-equipped to handle this challenge.

ARB evaluated a comprehensive array of approaches and tools to achieve these emission reductions. Reducing greenhouse gas emissions from the wide variety of sources can best be accomplished though a cap-and-trade program along with a mix of complementary strategies that combine market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs. ARB will monitor implementation of these measures to ensure that the State meets the 2020 limit on greenhouse gas emissions.

An overall limit on greenhouse gas emissions from most of the California economy – the "capped sectors" – will be established by the cap-and-trade program. (The basic elements of the cap-and-trade program are described later in this chapter.) Within the capped sectors, some of the reductions will be accomplished through direct regulations such as improved building efficiency standards and vehicle efficiency measures. Whatever additional reductions are needed to bring emissions within the cap are accomplished through price incentives posed by emissions allowance prices. Together, direct regulation and price incentives assure that emissions are brought down cost-effectively to the level of the overall cap. ARB also recommends specific measures for the remainder of the economy – the "uncapped sectors."

Key elements of California's recommendations for reducing its greenhouse gas emissions to 1990 levels by 2020 include:

- **Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;**
- **Achieving a statewide renewables energy mix of 33 percent;**
- **Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;**
- **Establishing targets for transportation-related greenhouse gas emissions for regions throughout California and pursuing policies and incentives to achieve those targets;**
- **Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and**
- **Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.**

The recommended greenhouse gas emissions reduction measures are listed in Table 2 and are summarized in Section C below. The total reduction for the recommended measures slightly exceeds the 169 $MMTCO_2E$ of reductions estimated in the Draft Scoping Plan. This is the net effect of adding several measures and adjusting the emission reduction estimates for some other measures. The 2020 emissions cap in the cap-and-trade program is preserved at the same level as in the Draft Scoping Plan (365 $MMTCO_2E$).

The measures listed in Table 2 lead to emissions reductions from sources within the capped sectors (146.7 $MMTOCO_2E$) and from sources or sectors not covered by cap-and-trade (27.3 $MMTCO_2E$). As mentioned, within the capped sectors the reductions derive both from direct regulation and from the incentives posed by allowance prices. Further discussion of how the cap-and-trade program and the complementary measures work together to achieve the overall target is provided below.

Table 2 also lists several other recommended measures which will contribute toward achieving the 2020 statewide goal, but whose reductions are not (for various reasons including the potential for double counting) additive with the other measures. Those measures and the basis for not including their reductions are further discussed in Section C.

Table 2: Recommended Greenhouse Gas Reduction Measures

Recommended Reduction Measures	Reductions Counted Towards 2020 Target ($MMTCO_2E$)	
ESTIMATED REDUCTIONS RESULTING FROM THE COMBINATION OF CAP-AND-TRADE PROGRAM AND COMPLEMENTARY MEASURES		**146.7**
California Light-Duty Vehicle Greenhouse Gas Standards • Implement Pavley standards • Develop Pavley II light-duty vehicle standards	31.7	
Energy Efficiency • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)	26.3	
Renewables Portfolio Standard (33% by 2020)	21.3	
Low Carbon Fuel Standard	15	
Regional Transportation-Related GHG Targets[16]	5	
Vehicle Efficiency Measures	4.5	
Goods Movement • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.7	
Million Solar Roofs	2.1	
Medium/Heavy Duty Vehicles • Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) • Medium- and Heavy-Duty Vehicle Hybridization	1.4	
High Speed Rail	1.0	
Industrial Measures (for sources covered under cap-and-trade program) • Refinery Measures • Energy Efficiency & Co-Benefits Audits	0.3	
Additional Reductions Necessary to Achieve the Cap	34.4	
ESTIMATED REDUCTIONS FROM UNCAPPED SOURCES/SECTORS		**27.3**
High Global Warming Potential Gas Measures	20.2	
Sustainable Forests	5.0	
Industrial Measures (for sources not covered under cap and trade program) • Oil and Gas Extraction and Transmission	1.1	
Recycling and Waste (landfill methane capture)	1.0	
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET		**174**
Other Recommended Measures	**Estimated 2020 Reductions ($MMTCO_2E$)**	
State Government Operations	1-2	
Local Government Operations	TBD	
Green Buildings	26	
Recycling and Waste • Mandatory Commercial Recycling • Other measures	9	
Water Sector Measures	4.8	
Methane Capture at Large Dairies	1.0	

[16] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB will establish regional targets for each Metropolitan Planning Organization (MPO) region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

The development of a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system is a central feature of the overall recommendation. This program will lead to prices on greenhouse gas emissions, prices that will spur reductions in greenhouse gas emissions throughout the California economy, through application of existing technologies and through the creation of new technological and organizational options. The rationale for combining a cap-and-trade program with complementary measures was outlined by the Market Advisory Committee, which noted the following in its recommendations to the ARB:

> Before setting out the key design elements of a cap-and-trade program it is important to explain how the proposed emissions trading approach relates to other policy measures. The following considerations seem especially relevant:
>
> - The emissions trading program puts a cap on the total emissions generated by facilities covered under the system. Because a certain number of emissions allowances are put in circulation in each compliance period, this approach provides a measure of certainty about the total quantity of emissions that will be released from entities covered under the program.
> - The market price of emissions allowances yields an enduring price signal for GHG emissions across the economy. This price signal provides incentives for the market to find new ways to reduce emissions.
> - By itself, a cap-and-trade program alone will not deliver the most efficient mitigation outcome for the state. There is a strong economic and public policy basis for other policies that can accompany an emissions trading system. [17]

The Economic and Technology Advancement Advisory Committee (ETAAC) also addressed the benefits associated with a combined policy of cap and trade and complementary measures.

> A declining cap can send the right price signals to shape the behavior of consumers when purchasing products and services. It would also shape business decisions on what products to manufacture and how to manufacture them. Establishing a price for carbon and other GHG emissions can efficiently tilt decision-making toward cleaner alternatives. This cap and trade approach (complemented by technology-forcing performance standards) avoids the danger of having government or other centralized decision-makers choose specific technologies, thereby limiting the flexibility to allow other options to emerge on a level playing field.

[17] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 19. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008)

> If markets were perfect, such a cap and trade system would bring enough new technologies into the market and stimulate the necessary industrial RD&D to solve the climate change challenge in a cost effective manner. As the Market Advisory Committee notes, however, placing a price on GHG emissions addresses only one of many market failures that impede solutions to climate change. Additional market barriers and co-benefits would not be addressed if a cap and trade system were the only state policy employed to implement AB 32. Complementary policies will be needed to spur innovation, overcome traditional market barriers (e.g., lack of information available to energy consumers, different incentives for landlords and tenants to conserve energy, different costs of investment financing between individuals, corporations and the state government, etc.) and address distributional impacts from possible higher prices for goods and services in a carbon-constrained world.[18]

The Environmental Justice Advisory Committee (EJAC) also supports an approach that includes a price on carbon along with complementary measures. Although the EJAC recommends that the carbon price be established through a carbon fee rather than through a cap-and-trade program, they recognize the importance of mutually supportive policies:

> California should establish a three-pronged approach for addressing greenhouse gases: (1) adopting standards and regulations; (2) providing incentives; and (3) putting a price on carbon via a carbon fee. The three pieces support one another and no single prong can work without equally robust support from the others.[19]

In keeping with the rationale outlined above, ARB finds that it is critically important to include complementary measures directed at emission sources that are included in the cap-and-trade program. These measures are designed to achieve cost-effective emissions reductions while accelerating the necessary transition to the low-carbon economy required to meet the 2050 target:

- The already adopted Light-Duty Vehicle Greenhouse Gas Standards are designed to accelerate the introduction of low-greenhouse gas emitting vehicles, reduce emissions and save consumers money at the pump.
- The Low Carbon Fuel Standard (LCFS) is a flexible performance standard designed to accelerate the availability and diversity of low-carbon fuels by taking into consideration the full life-cycle of greenhouse gas emissions. The LCFS will reduce emissions and make our economy more resilient to future petroleum price volatility.
- The Regional Transportation-Related Greenhouse Gas Targets provide incentives for channeling investment into integrated development patterns and transportation

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[18] Recommendations of the Economic and Technical Advancement Advisory Committee (ETAAC), Final Report. *Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California*. February 14, 2008. pp. 1-4 http://www.arb.ca.gov/cc/etaac/ETAACFinalReport2-11-08.pdf (accessed October 12, 2008)

[19] Recommendations and Comments of the Environmental Justice Advisory Committee on the Implementation of the Global Warming Solutions Act of 2006 (AB32) on the Draft Scoping Plan. October 2008. p. 10. http://www.arb.ca.gov/cc/ejac/ejac_comments_final.pdf (accessed October 12, 2008)

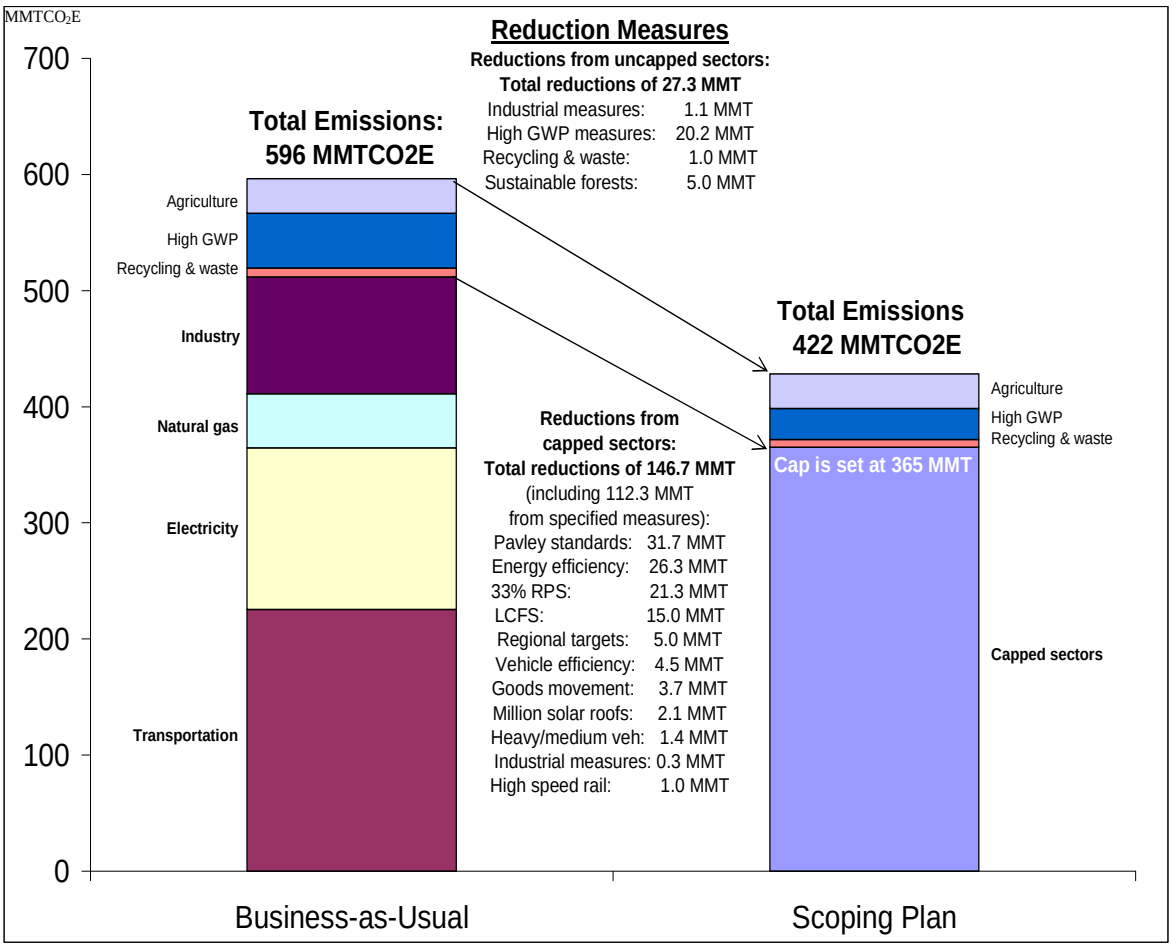
infrastructure, through improved planning. Improved planning and the resulting development are essential for meeting the 2050 emissions target.

- In the Energy sector, measures will provide better information and overcome institutional barriers that slow the adoption of cost-effective energy efficiency technologies. Enhanced energy efficiency programs will provide incentives for customers to purchase and install more efficient products and processes, and building and appliance standards will ensure that manufacturers and builders bring improved products to market.
- The Renewables Portfolio Standard (RPS) promotes multiple objectives, including diversifying the electricity supply. Increasing the RPS to 33 percent is designed to accelerate the transformation of the Electricity sector, including investment in the transmission infrastructure and system changes to allow integration of large quantities of intermittent wind and solar generation.
- The Million Solar Roofs Initiative uses incentives to transform the rooftop solar market by driving down costs over time.
- The Goods Movement program is primarily intended to achieve criteria and toxic air pollutant reductions but will provide important greenhouse gas benefits as well.
- Similar to the light duty vehicle greenhouse gas standards, the heavy duty and medium duty vehicle measures and the additional light duty vehicle efficiency measures aim to achieve cost-effective reductions of GHG emissions and save fuel.

Each of these complementary measures helps to position the California economy for the future by reducing the greenhouse gas intensity of products, processes, and activities. When combined with the absolute and declining emissions limit of the cap-and-trade program, these policies ensure that we cost-effectively achieve our greenhouse gas emissions goals and set ourselves on a path towards a clean low carbon future.

Figure 3 illustrates how the recommended emission reduction measures together put California on a path toward achieving the 2020 goal. The left hand column in Figure 3 shows total projected business as usual emissions in 2020, by sector (596 $MMTCO_2E$). The right hand column shows 2020 emissions after applying the Scoping Plan recommended reduction measures (422 $MMTCO_2E$). The measures that accomplish the needed reductions are listed in between the columns. As Figure 3 shows, there are a total of 27.3 $MMTCO_2E$ in reductions from uncapped sectors, and 146.7 $MMTCO_2E$ in reductions from capped sectors.

Figure 3: California Greenhouse Gas Emissions in 2020 and Recommended Reduction Measures



The recommended cap-and-trade program provides covered sources with the flexibility to pursue low cost reductions. It is important to recognize, however, that other recommended measures also provide compliance flexibility. As is often the case with ARB regulations, many of the measures establish performance standards and allow regulated entities to determine how best to achieve the required emission level. This approach rewards innovation and allows facilities to take advantage of the best way to meet the overarching environmental objective.

Table 3 lists the proposed measures that include compliance flexibility or market mechanisms. This flexibility ranges from the potential for tradable renewable energy credits in the Renewables Portfolio Standard to the incentives to encourage emission reductions in electricity and natural gas efficiency programs to the averaging, banking and trading mechanisms in the Pavley and Low Carbon Fuel Standard programs to a multi-sector cap-and-trade program.

Table 3: Measures With Flexible Market Compliance Features

Measure	Estimated Reductions
Additional Reductions from Capped Sectors	34.4
California Light-Duty Vehicle Greenhouse Gas Standards (Pavley I & II)	31.7
Renewables Portfolio Standard	21.3
Electricity Efficiency	15.2
Low Carbon Fuel Standard	15.0
Mitigation Fee on High GWP Gases	5.0
Natural Gas Efficiency	4.3
Goods Movement Systemwide Efficiency	3.5
Medium/Heavy Duty Vehicle Hybridization	0.5
Total	**130.9**

The recommended mix of measures builds on a strong foundation of previous action in California to address climate change and broader environmental issues. The program recommended here relies on implementing existing laws and regulations that were adopted to reduce greenhouse gas emissions and other policy goals; strengthening and expanding existing programs; implementing the discrete early actions adopted by the Board in 2007; and new measures developed during the Scoping Plan process itself.

The mix of measures recommended in this Plan provides a comprehensive approach to reduce emissions to achieve the 2020 target, and to initiate the transformations required to achieve the 2050 target. The cap-and-trade program and complementary measures will cover about 85 percent of greenhouse gas emissions throughout California's economy. ARB recognizes that due to several factors, including information discovered during regulatory development, technology maturity, and implementation challenges, actual reductions from individual measures aimed at achieving the 2020 target may be higher or lower than current estimates. The inclusion of many of these emissions within the cap-and-trade program, along with a margin of safety in the uncapped sectors, will help ensure that the 2020 target is met. The combination of approaches provides certainty that the overall program will meet the target despite some degree of uncertainty in the estimates for any individual measure. Additionally, by internalizing the cost of CO_2E emissions throughout the economy, the cap-and-trade program supports the complementary measures and provides further incentives for innovation and continuing emissions reductions from energy producers and consumers setting us on a path toward our 2050 goals.

Some emissions sources are not currently suitable for inclusion in the cap-and-trade program due to challenges associated with precise measurement, tracking or sector structure. For these emissions sources, ARB is including measures designed to focus on waste management, agriculture, forestry, and certain emissions of high GWP gases, a rapidly growing component of California's greenhouse gas emissions inventory.

California's economy is expected to continue to experience robust growth through 2020. Economic modeling, including evaluation of the effects on low-income Californians, shows that the measures included within this Scoping Plan can be implemented with a net positive effect on California's long-term economic growth. The evaluation of related public health and environmental benefits of the various measures also shows that implementation will result in not only reduced greenhouse gas emissions and improved public health, but also in a beneficial effect on California's environment. The results of these evaluations are presented in Chapter III.

AB 32 includes specific criteria that ARB must consider before adopting regulations for market-based compliance mechanisms to implement a greenhouse gas reduction program, and directs the Board, to the extent feasible, to design market-based compliance mechanisms to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants. In the development of regulations that contain market mechanisms, ARB will consider the economic, environmental and public health effects, and the evaluation of potential localized impacts. These results will be used to institute appropriate economic, environmental and public health safeguards.

ARB has also designed the recommendation to ensure that reductions will come from throughout the California economy. Transportation accounts for the largest share of California's greenhouse gas emissions. Accordingly, a large share of the reduction of greenhouse gas emissions from the recommended measures comes from this sector. Measures include the inclusion of transportation fuels in the cap-and-trade program, the Low Carbon Fuel Standard to reduce the carbon intensity of transportation fuels, enforcement of regulations that reduce greenhouse gas emissions from vehicles, and policies to reduce transportation emissions by changes in future land use patterns and community design as well as improvements in public transportation.

In the Energy sector, the recommended measures increase the amount of electricity from renewable energy sources, and improve the energy efficiency of industries, homes and buildings. The inclusion of these sectors and the Industrial sector in the cap-and-trade program provides further assurance that significant cost-effective reductions will be achieved from the sectors that contribute the greatest emissions. Additional energy production from renewable resources may also rely on measures suggested in the Agriculture, Water, and the Recycling and Waste Management Sectors.

Other sectors are also called upon to cut emissions. The cap-and-trade program covers industrial sources and natural gas use. The recommended measures would require industrial processes to examine how to lower their greenhouse gas emissions and be more energy efficient, and would require goods movement operations through California's ports to be more energy efficient. Other measures address waste management, agricultural and forestry practices, as well as the transport and treatment of water throughout the state. Finally, the recommended measures address ways to reduce or eliminate the emissions of high global warming potential gases that, on a per-ton basis, contribute to global warming at a level many times greater than carbon dioxide.

As the Scoping Plan is implemented, ARB and other agencies will coordinate with the Green Chemistry Initiative, particularly in the Green Building and Recycling/Waste sectors. Green Chemistry is a fundamentally new approach to environmental protection that emphasizes environmental protection at the design stage of product and manufacturing processes, rather than focusing on end-of-pipe or end-of-life activities, or a single environmental medium, such as air, water or soil. This new approach will reduce the use of harmful chemicals, generate less waste, use less energy, and, accordingly, will contribute toward California's greenhouse gas reduction goals.

A. The Role of State Government: Setting an Example

For many years California State government has successfully incorporated environmental principles in managing its resources and running its business. The Governor has directed State agencies to sharply reduce their building-related energy use and encouraged our State-run pensions to invest in energy efficient and clean technologies.[20] The State also has been active in procuring low-emission, alternative fuel vehicles in its large fleet.

While State government has already accomplished much to reduce its greenhouse gas emissions, it can and must do more. State agencies must lead by example by continuing to reduce their greenhouse gas emissions. Therefore, California State government has established a target of reducing its greenhouse gas emissions by a *minimum* of 30 percent below its estimated business-as-usual emissions by 2020 – approximately a 15 percent reduction from current levels.

As an owner-operator of key infrastructure, State government has the ability to ensure that the most advanced, cost-effective environmental performance requirements are used in the design, construction, and operation of State facilities. As a purchaser with significant market power, State government has the ability to demand that the products and services it procures contribute positively toward California's targets to reduce greenhouse gas emissions, such as through the efforts of Environmentally Preferable Purchasing. As an investor of more than $400 billion,[21] State government has the ability to prioritize low-carbon investments. With more than 350,000 employees, State government is uniquely situated to adopt and implement policies that give State workers the ability to decrease their individual carbon impact, including encouraging siting facilities within communities to enhance balance in jobs and housing, encouraging carpooling, biking, walking, telecommuting, the use of public transit, and the use of alternative work schedules.

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[20]Governor Schwarzenegger signed Executive Order Executive Order S-20-04 on December 14, 2004. This Order contains a number of directives, including a set of aggressive goals for reducing state building energy use and requested the California Public Employees Retirement System (CalPERS) and the California State Teachers Retirement System (CalSTRS) to target resource-efficient buildings for real estate investments and commit funds toward clean, efficient and sustainable technologies.

[21] CalPERS and CalSTRS are the two largest pension systems in the nation with investments in excess of $400 billion as of August 2008.

Myriad opportunities exist for California State government to operate more efficiently. These opportunities will not only reduce greenhouse gas emissions but also will produce savings for California taxpayers. Initiatives now underway that will contribute to the State government reduction target include the Governor's Green Building Initiative and the Department of General Services' efforts to increase the number of fuel-efficient vehicles in the State fleet.

Major efforts to expand renewable energy use and divest from coal-fired power plants are currently underway. Together with energy conservation and efficiency strategies on water projects, roadways, parks, and bridges, these efforts all play major roles in reducing the State's greenhouse gas emissions. State agencies should review their travel practices and make greater use of teleconferencing and videoconferencing to reduce the need for business travel, particularly air travel.

State agencies are now examining their policies and operations to determine how they can reduce their greenhouse gas emissions. These findings will be instrumental as each cabinet-level agency registers with the California Climate Action Registry (CCAR) to record and report their individual carbon footprints. The Climate Action Team has created a new State Government Operations sub-group that will work closely with the agencies to review the results of their evaluations and the CCAR reports to determine how best to achieve the maximum reductions possible.

State agencies must take the lead in driving this low-carbon economy by reducing their own emissions, and also by serving as a catalyst for local government and private sector activity. New "Best Practices" implemented by State agencies can be transferred to other entities within California, the nation, and internationally. By increasing cooperation and coordination across organizational boundaries, State government will maximize the experience and contributions of each agency involved to achieve the 30 percent reduction of greenhouse gas emissions while growing the economy and protecting the environment.

State government's impact on emissions goes far beyond its own buildings, vehicles, projects, and employees. State government casts a sizable "carbon shadow"– that is, the climate change impact of legislative, executive, and financial actions of State agencies that affect Californians now and in the future. For example, the California Energy Commission (CEC) recently initiated a proceeding to consider how to align its permitting process with the State's greenhouse gas and renewable energy policy goals. ARB intends to work closely with the CEC during this proceeding. New power plants, both fossil-fuel fired and renewable generation, will be a critical part of the state's electricity mix in coming decades. The investments that are made in this new infrastructure in the next several years will become part of the backbone of the state's electricity supply for decades to come. This timely investigation will be a critical element of California's ability to meet the AB 32 emissions reduction target for 2020, the ambitious target set by the Governor for 2050, and also the specific goal of achieving 33 percent renewables in the state's electricity mix. The Governor's Office of Planning and Research and the Resources Agency are developing proposed amendments to the California Environmental Quality Act (CEQA) Guidelines to

provide guidance on how to address greenhouse gases in CEQA documents. As required by SB 97 (Chapter 185, Statutes of 2007), the amended CEQA guidelines will be adopted by January 1, 2010.

In addition, agencies such as the California Labor and Workforce Development Agency, the Business, Transportation and Housing Agency and the newly created Green Collar Jobs Council (AB 3018, Chapter 312, Statutes of 2008) are dedicated to economic development, training, safety, labor relations, and employment development throughout the State. ARB will coordinate with the Council and also with other State agencies to address workforce needs and facilitate a smooth transition to California's emerging low-carbon economy that maximizes economic development and employment opportunities in California.

The State expends funds to provide services to California residents – from preserving our natural resources to building and maintaining infrastructure like roads, bridges and dams. California residents should reap all of the benefits of these projects, including any associated quantifiable and marketable reductions in greenhouse gas emissions. Because of this, California should retain ownership of these greenhouse gas emissions reductions and use them to promote the goals of AB 32 and other goals of the state.

California State government can also lead through example by aligning its efforts to reduce greenhouse gas emissions with efforts to protect and improve public health. As a new member of the Climate Action Team, the Department of Public Health will help ensure that measures to combat global warming also incorporate public health protection and improvement strategies. As discussed below, these and many other State leadership efforts can be built upon at the local level as well.

B. The Role of Local Government: Essential Partners

Local governments are essential partners in achieving California's goals to reduce greenhouse gas emissions. They have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect greenhouse gas emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Many of the proposed measures to reduce greenhouse gas emissions rely on local government actions.

Over 120 California cities have already signed on to the U.S. Conference of Mayors Climate Protection Agreement. In addition, over 30 California cities and counties have committed to developing and implementing Climate Action Plans. Many local governments and related organizations have already begun educating Californians on the benefits of energy efficiency measures, public transportation, solar homes, and recycling. These communities have not only demonstrated courageous leadership in taking initiative to reduce greenhouse gas emissions, they are also reaping important co-benefits, including local economic benefits, more sustainable communities, and improved quality of life.

Land use planning and urban growth decisions are also areas where successful implementation of the Scoping Plan relies on local government. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions. Decisions on how land is used will have large impacts on the greenhouse gas emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors.

To provide local governments guidance on how to inventory and report greenhouse gas emissions from government buildings, facilities, vehicles, wastewater and potable water treatment facilities, landfill and composting facilities, and other government operations, ARB recently adopted the Local Government Operations Protocol. ARB encourages local governments to use this protocol to track their progress in achieving reductions from municipal operations. ARB is also developing an additional protocol for community emissions. This protocol will go beyond just municipal operations and include emissions from the community as a whole, including residential and commercial activity. These local protocols will play a key role in ensuring that strategies that are developed and implemented at the local level, like urban forestry and greening projects, water and energy efficiency projects, and others, can be appropriately quantified and credited toward California's efforts to reduce greenhouse gas emissions.

In addition to tracking emissions using these protocols, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020. To consolidate climate action resources and aid local governments in their emission reduction efforts, the ARB is developing various tools and guidance for use by local governments, including the next generation of best practices, case studies, a calculator to help calculate local greenhouse gas emissions, and other decision support tools.

The recent passage of SB 375 (Steinberg, Chapter 728, Statutes of 2008) creates a process whereby local governments and other stakeholders work together within their region to achieve reduction of greenhouse gas emissions through integrated development patterns, improved transportation planning, and other transportation measures and policies. The implementation of regional transportation-related greenhouse gas emissions targets and SB 375 are discussed in more detail in Section C.

C. Emissions Reduction Measures

The Scoping Plan will build on California's successful history of balancing effective regulations with economic progress. Several types of measures have been recommended. The plan includes a California cap-and-trade program that will be integrated with a broader regional market to maximize cost-effective opportunities to achieve GHG emissions reductions. The plan also includes transformational measures that are designed to help pave the path toward California's clean energy future. For example, the Low Carbon Fuel

Standard (LCFS) is a performance standard with flexible compliance mechanisms that will incent the development of a diverse set of clean, low-carbon transportation fuel options. Similarly, the plan recognizes the importance of local and regional government leadership in ensuring that California's land use and transportation planning processes are designed to be consistent with efforts to achieve a clean energy future and to protect and enhance public health and safety.

The Scoping Plan also contains a number of targeted measures that are designed to overcome existing barriers to action such as lack of information, lack of coordination, or other regulatory and institutional factors. Energy efficiency is a classic example where cost-effective action often is not taken due to lack of complete information, relatively high initial costs, and mismatches between who pays for and who benefits from efficiency investments. These problems often mean that efficiency measures are not taken that would save money in the long term for small businesses, home owners and renters. While California has a long history of success in implementing regulations and programs to encourage energy efficiency, innovative methods to overcome these economic and information barriers are needed to provide the benefits of increased efficiency to more Californians and to meet our greenhouse gas emissions reduction goals.

Several of the recommended measures complement each other. For example, the LCFS will provide clean transportation fuel options. The Pavley performance standards help deploy vehicles that can use many of the low-carbon fuels, including advanced biofuels, electricity and hydrogen. The combined operation of both programs will make it more likely that more efficient, less polluting vehicles will use the cleanest possible fuels. In addition, both of these programs will benefit from ARB's zero-emission vehicle program, which focuses on deployment of plug-in battery-electric and fuel cell vehicles. All of these strategies are expandable beyond 2020, and are needed as vital components to reach the State's 2050 goal.

The cap-and-trade program creates an emissions limit or "cap" on the sectors responsible for the vast majority of California's greenhouse gas emissions and provides capped sources significant flexibility in how they collectively achieve the reductions necessary to meet the cap. The other measures in these capped sectors provide a clear path toward achieving reductions required by the cap, while simultaneously addressing market barriers and creating the low-carbon energy options needed to achieve our long term climate goals. In the design of the cap-and-trade program, ARB will also evaluate possible ways to include features that complement the other measures, such as consideration of allowance set-asides that could be used to help achieve or exceed the aggressive energy efficiency goals included in this Plan.

Both required measures and other cost-effective actions by capped sectors will contribute toward achievement of the cap. For example, increasing energy efficiency will reduce electricity demand, thereby reducing the need for utilities to submit allowances to comply with the cap-and-trade program. In this way, energy efficiency contributes to real reductions toward the cap. Expiration of existing utility long-term contracts with coal plants will reduce GHG emissions when such generation is replaced by renewable generation, coal with carbon sequestration, or natural gas generation, which emits less CO_2 per megawatt-hour.

Additionally, measures and other actions that result in reductions in energy demand 'downstream' of capped sectors will help achieve the cap. For example, the Pavley vehicle standards, building efficiency standards, and land use planning that contributes to reduced transportation fuel demand will all reduce emissions by reducing the demand for upstream energy production. These downstream entities will further benefit from these reductions by avoiding any costs that would be passed through from a cap-and-trade system.

Discrete Early Actions

In September 2007, ARB approved a list of nine Discrete Early Actions to reduce greenhouse gas emissions and is currently in the process of developing regulations and programs based on these measures. Regulations implementing the Discrete Early Action measures must be adopted and in effect by January 1, 2010 (HSC §38560.5 (b)). All the Discrete Early Actions are included in the recommended measures and are shown below in Table 4.

Table 4: Anticipated Board Consideration Dates for Discrete Early Actions

Discrete Early Action	Anticipated Board Consideration
Green Ports – Ship Electrification at Ports	December 2007 – Adopted
Reduction of High GWP Gases in Consumer Products	June 2008 – Adopted
SmartWay – Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency)	December 2008
Reduction of Perfluorocarbons from Semiconductor Manufacturing	February 2009
Improved Landfill Gas Capture	January 2009
Reduction of HFC-134a from Do-It-Yourself Motor Vehicle Servicing	January 2009
SF_6 Reductions from the Non-Electric Sector	January 2009
Tire Inflation Program	March 2009
Low Carbon Fuel Standard	March 2009

The following sections describe the recommended measures in this Scoping Plan. Additional information about these measures is provided in Appendix C.

1. California Cap-and-Trade Program Linked to Western Climate Initiative Partner Jurisdictions

Implement a broad-based California cap-and-trade program to provide a firm limit on emissions. Link the California cap–and-trade program with other Western Climate Initiative Partner programs to create a regional market system to achieve greater environmental and economic benefits for California. Ensure California's program meets all applicable AB 32 requirements for market-based mechanisms.

California is working closely with other states and provinces in the Western Climate Initiative (WCI) to design a regional cap-and-trade program that can deliver reductions of greenhouse gas emissions throughout the region. ARB will develop a cap-and-trade program for California that will link with the programs in the other WCI Partner jurisdictions to create a regional cap-and-trade program. The WCI Partner jurisdictions released the program design document on September 23, 2008 (see Appendix D). ARB will continue to work with the WCI Partner jurisdictions to develop and implement the cap-and-trade program. ARB will also design the California program to meet the requirements of AB 32, including the need to consider any potential localized impacts and ensure that reductions are enforceable by the Board.

Based on the requirements of AB 32, regulations to implement the cap-and-trade program need to be developed by January 1, 2011, with the program beginning in 2012. This rule development schedule will be coordinated with the WCI timeline for developing a regional cap-and-trade program. Preliminary plans for this rulemaking are described later in this section.

A cap-and-trade program sets the total amount of greenhouse gas emissions allowable for facilities under the cap and allows covered sources, including producers and consumers of energy, to determine the least expensive strategies to comply. The emissions allowed under the cap will be denominated in metric tons of CO_2E. The currency will be in the form of allowances which the State will issue based upon the total emissions allowed under the cap during any specific compliance period. Emission allowances can be banked for future use, encouraging early reductions and reducing market volatility. The ability to trade allows facilities to adjust to changing conditions and take advantage of reduction opportunities when those opportunities are less expensive than buying additional emissions allowances.

Provisions could be made to allow a limited use of surplus reductions of greenhouse gas emissions that occur outside of the cap. These additional reductions are known as offsets and are discussed further below. In order to be used to meet a source's compliance obligation, offsets will be subject to stringent criteria and verification procedures to ensure their enforceability and consistency with AB 32 requirements.

Appendix C describes the fundamentals of a cap-and-trade program and program design elements. Appendix D contains the WCI Design Recommendations and related background documents.

California Cap-and-Trade Program

By providing a firm cap on 85 percent of the state's greenhouse gas emissions, the cap-and-trade regulatory program is an essential component of the overall plan to meet the 2020 target and provides a robust mechanism to achieve the additional reductions needed by 2050. To meet the emissions reduction target under AB 32, the limit on emissions allowed under the cap, plus emissions from uncapped sources, must be no greater than the 2020 emissions goal.

By setting a limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program will complement other measures for entities within covered sectors. Additionally, starting a cap-and-trade program now will set us on a course to achieve further emissions cuts well beyond 2020 and ensure that California is primed to take advantage of opportunities for linking with other programs, including future federal and international efforts.

The proposed cap-and-trade measure phases in the following sectors:

Starting in the first compliance period (2012):

- In-state electrical generating facilities that emit over 25,000 metric tons CO_2E per year,[22] including imports not covered by a WCI Partner jurisdiction.
- Large industrial facilities that emit over 25,000 metric tons CO_2E per year, including high global warming potential gases.

Starting in the second compliance period (2015):

- Upstream treatment of industrial fuel combustion at facilities with emissions at or below 25,000 metric tons CO_2E per year, and all commercial and residential fuel combustion regulated where the fuel enters into commerce
- Transportation fuel combustion regulated where the fuel enters into commerce.

For some energy-intensive industrial sources such as cement, stringent requirements in California, either through inclusion in a cap-and-trade program or through source-specific regulation, have the potential to create a disadvantage for California facilities relative to out-of-state competitors unless those locations have similar requirements (e.g., through the WCI). If production shifts outside of California in order to operate without being subject to these requirements, emissions could remain unchanged or even increase. This is referred to as "leakage." AB 32 requires ARB to design measures to minimize leakage. Minimizing leakage will be a key consideration when developing the cap-and-trade regulation and the other AB 32 program measures.[23]

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[22] Allowances will not be required for combustion emissions from carbon-neutral projects.

[23] The cement industry is an example of a sector that may be susceptible to this type of leakage, and the Draft Scoping Plan included consideration of a measure to institute an intensity standard at concrete batch plants that would consider this type of life-cycle emissions. ARB will evaluate whether this type of intensity standard could be incorporated into the cap-and-trade program or instituted as a complementary measure during the cap-and-trade rulemaking.

As shown in Table 5, the preliminary estimate of the cap on greenhouse gas emissions for sectors covered by the cap-and-trade program is 365 $MMTCO_2E$ in 2020, which covers about 85 percent of California's total greenhouse gas emissions.[24] Greenhouse gas emissions from most of the sectors covered by a cap-and-trade program will also be governed by other measures, including performance standards, efficiency programs, and direct regulations. These other measures will provide real reductions which will contribute reductions toward the cap.

In addition, ARB will work closely with the CPUC, CEC, and The California Independent System Operator to ensure that the cap-and-trade program works within the context of the State's energy policy and enables the reliable provision of electricity.

Table 5: Sector Responsibilities Under Cap-and-Trade Program
($MMTCO_2E$ in 2020)

Sector	Projected 2020 Business-as-Usual Emissions		Preliminary 2020 Emissions Limit under Cap-and-Trade Program
	By Sector	Total	
Transportation	225	512	365
Electricity	139		
Commercial and Residential	47		
Industry	101		

Linkage with the Western Climate Initiative Partner Jurisdictions

The WCI was formed in 2007. Members are California, Arizona, New Mexico, Oregon, Washington, Utah, and Montana, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec. The WCI Partner jurisdictions, including California, have adopted goals to reduce greenhouse gas emissions that, in total, reduce regional emissions to 15 percent below 2005 levels by 2020. This regional goal is approximately equal to California's goal of returning to 1990 levels by 2020. A cap-and-trade program is one element of the effort by the WCI Partner jurisdictions to identify, evaluate, and implement ways to reduce greenhouse gas emissions and achieve related co-benefits.

[24] The actual cap for the program will be established as part of the rulemaking process. The preliminary cap of 365 $MMTCO_2E$ in 2020 assumes that all of California's electricity imports would be covered under a California cap. Because a significant portion of California's imported electricity is from power plants located in other WCI Partner Jurisdictions, emissions from those sources could be included in the cap of the states within which the power plants are located. In establishing the California cap, ARB will need to consider the degree to which emissions from these sources are addressed as part of the WCI regional market.

The WCI Partner jurisdictions released their recommendation for the design of a regional cap-and-trade program in September 2008. This design document and the background paper that accompanied it are presented in Appendix D. These recommendations were developed collaboratively by the WCI Partner jurisdictions, including California, with a goal of achieving regional targets to reduce greenhouse gas emissions equitably and effectively. The WCI Partner jurisdictions' recommendations are generally consistent with the recommendations provided in June 2007 by the California Market Advisory Committee,[25] the recommendations provided to ARB by the California Public Utilities Commission and the California Energy Commission in March 2008,[26] and the proposed opinion released by the two Commissions in September 2008.[27]

Participating in a regional system has several advantages for California. The reduction of greenhouse gas emissions that can be achieved collectively by the WCI Partner jurisdictions are approximately double what can be achieved through a California-only program. The broad scope of a WCI-wide market will provide additional opportunities for reduction of emissions, therefore providing greater market liquidity and more stable carbon prices within the program. The regional system also significantly reduces the potential for leakage, which is a shift in economic and emissions activity out of California that could hurt the state's economy without reducing global greenhouse gas emissions. Harmonizing the approach and timing of California's requirements for reducing greenhouse gas emissions with other states and provinces in the region can encourage retention of local businesses in the state. Further, by creating a cost-effective regional market system, California and the other WCI Partner jurisdictions will continue to demonstrate leadership in preparation for future federal and international climate action.

To achieve the individual WCI Partner jurisdiction goals and the regional goal, each WCI Partner jurisdiction will have an allowance budget based on its goal that declines to 2020. For example, California's allowance budget will be based on the level of emissions needed to achieve the AB 32 target for 2020, as described above. Once California links with the other WCI Partner jurisdictions, allowances could be

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[25] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 19. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008) Cal/EPA The Market Advisory Committee (MAC) consisted of a consortium of economists, policy makers, academics, government representatives, and environmental advocates who came together through the auspices of CalEPA, pursuant to Executive Order S-20-06 from Governor Schwarzenegger.

[26] Joint Agency Decision of the CEC and the CPUC. *Final Adopted Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*, March 13, 2008. Document number CEC-100-2008-002-F. http://www.energy.ca.gov/2008publications/CEC-100-2008-002/CEC-100-2008-002-F.PDF (accessed October 12, 2008)

[27] Joint Agency proposed final opinion of the CEC and the CPUC. *Proposed Final Opinion on Greenhouse Gas Regulatory Strategies*. Published September 12, 2008 and to be considered for adoption on October 16, 2008 by the CEC and the CPUC. Document Number CEC-100-2008-007-D http://www.energy.ca.gov/ghg_emissions/index.html (accessed October 12, 2008)

traded across state and provincial boundaries. As a result of trading, emissions in a state may vary from its allowance budget, although total regional emissions will not exceed the regional cap.

The overall number of allowances issued in a given year by the WCI Partner jurisdictions will set a limit on emissions from sectors covered by the program for the region. Details of distribution of allowances will be established by each partner within the general guidelines set forth in the WCI program design framework. The WCI Partner jurisdictions have agreed to consider standardizing allowance distribution across specific sectors if necessary to address competitiveness issues. In addition, the WCI Partner jurisdictions have agreed to phase in regionally coordinated auctions of allowances, with a minimum percentage of allowances auctioned in each period starting with 10 percent in the first compliance period and increasing to 25 percent in 2020. WCI partners aspire to reach higher auction percentages over time, possibly to 100 percent. Under the program design, each WCI Partner jurisdiction, including California, can auction a greater portion of its allowance budget in any compliance period. The distribution of California's allowances will be determined during the cap-and-trade rulemaking process, as discussed below.

The WCI Partner jurisdictions are also proposing the use of an allowance reserve price for the first 5 percent of the auctioned allowances in the regional cap. A reserve price will help to ensure that the cap is set at a level that will motivate real emissions reductions and may provide an opportunity for the regional cap-and-trade program to provide reductions that exceed the regional target.

A regional coordinated cap-and-trade program with strong reporting and enforcement rules will provide a high degree of certainty that emissions will not exceed targeted levels and that leakage will not occur.

Federal Action

A cap-and-trade program is expected to be a significant element in any future federal action taken to reduce greenhouse gas emissions. ARB's efforts to design a broad cap-and-trade system that works in concert with sector- or source-related measures and meets the requirements of AB 32 can serve as a model for a federal program. An effective, enforceable regional cap-and-trade program can promote the type of federal legislation needed to meet the pressing challenge of climate change. In the event that California businesses, organizations, or individuals hold regional allowances when a federal system is implemented, California will work to ensure that those allowances continue to have value, either in a continuing regional program or within the federal program.

Cap-and-Trade Rulemaking

To implement the cap-and-trade program, ARB will embark on regulatory development that includes extensive and broad-based public participation. Major program design elements will include setting an emissions cap in conjunction with the

WCI Partner jurisdictions, determining the method of distributing both allowances and revenues raised through auctions, and establishing the rules for the use of offsets. ARB will continue to work with all affected stakeholders, State and local agencies, and our WCI partners to create a robust regional market system.

After adoption of the Scoping Plan, ARB will establish a formal structure to elicit ongoing participation in the rulemaking process from a wide range of affected stakeholders. While the process will be open to involvement by all interested parties, ARB anticipates creation of a series of focused working groups that include participation by representatives of the regulated community, environmental and community advocates and other public interest groups, prominent academics with expertise in cap-and-trade issues and new technology development, local air pollution control districts, stakeholders in the WCI, and other State agencies with existing authority for regulating capped sectors.

This process will integrate economic and administrative design considerations and include consideration of environmental and public health issues. ARB will convene a series of technical workshops to examine mechanisms to address the concerns related to the cap-and-trade program raised by the Environmental Justice Advisory Committee and other stakeholders. The first workshop will explore cap-and-trade program design options that could provide incentives to maximize additional environmental and economic benefits, and to analyze the proposed program to prevent increases in emissions of toxic air contaminants or criteria pollutants through the design and architecture of the program itself. Similar technical workshops will focus on issues related to offsets and the WCI proposal.

Allowances and Revenues

Emission allowances represent a significant economic value whether they are freely allocated or sold through auction. Section E includes a preliminary discussion of some of the options that have been suggested for use of allowance value or revenues. ARB will evaluate the possible uses of allowances or revenues as part of the rulemaking process. One approach would be to dedicate a portion of the allowances for such purposes as rewarding early actions to reduce emissions, providing incentives for local governments and others to promote energy efficiency, better land use planning, and other reduction strategies, and targeting projects to reduce emissions in low-income or disadvantaged communities. This type of dedicated use of allowances is typically referred to as an allowance ‘set-aside.’

The California Public Utilities Commission and the California Energy Commission addressed the question of allocation and auction of allowances in their joint proceeding on implementation of AB 32 for the Electricity and Natural Gas sectors. They have recently released a proposed opinion that recommends to ARB a transition

to 100 percent auction for the Electricity sector by 2016.[28] The CPUC and CEC included in their draft opinion the recommendation that all auction revenues be used for purposes related to AB 32, and all revenue from allowances allocated to the Electricity sector and received by retail providers would be used for the benefit of the Electricity sector to support investments in renewable energy, efficiency, new energy technology, infrastructure, customer bill relief, and other similar programs.

The Market Advisory Committee also recommended the eventual transition to full auction within the cap-and-trade program, noting that a system in which California ultimately auctions all of its emission allowances is consistent with fundamental objectives of cost-effectiveness, fairness and simplicity.[29] ARB agrees that the transition to a 100 percent auction, with auction revenue going to further the policy objectives of California's climate change program, is a worthwhile goal. ARB expects that California will auction significantly more than the WCI minimum levels and will transition to 100 percent auction. However a broad set of factors must be considered in evaluating the potential timing of a transition to a full auction including competiveness, potential for emissions leakage, the effect on regulated vs. unregulated industrial sectors, the overall impact on consumers, and the strategic use of auction revenues.

Allowance allocation and revenue use decisions can greatly affect the equity of a cap-and-trade system. Addressing both these issues will be a major part of the rulemaking process. ARB will seek input from a broad range of experts in an open public process regarding the options for allocation and revenue use under consideration by ARB and the WCI Partner jurisdictions. This process will evaluate various mechanisms ARB is considering for allowance distribution and potential uses of allowance value, including the recommendations offered by CPUC and CEC. Issues to be considered will include the appropriate timing and structure of a transition to full auction of allowances, the potential need to harmonize the allocation process regionally for certain sectors subject to inter-state competition, and equity across the various sectors here in California.

Offsets

Individual projects can be developed to achieve the reduction of emissions from activities not otherwise regulated, covered under an emissions cap, or resulting from government incentives. These projects can generate "offsets," i.e., verifiable reductions of emissions whose ownership can be transferred to others. The cap-and-trade rulemaking will establish appropriate rules for use of offsets. As required by

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[28] Op. Cit. The proposed opinion has not yet been voted on by either the CPUC or the CEC. The Commissions are expected to vote on this proposed opinion before the December Board meeting when the Proposed Scoping Plan will be considered for approval.

[29] Recommendations of the Market Advisory Committee to the California Air Resources Board. *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. June 30, 2007. p. 55. http://www.climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF (accessed October 12, 2008)

AB 32, any reduction of greenhouse gas emissions used for compliance purposes must be real, permanent, quantifiable, verifiable, enforceable, and additional (HSC §38562(d)(1) and (2)). Offsets used to meet regulatory requirements must be quantified according to Board-adopted methodologies, and ARB must adopt a regulation to verify and enforce the reductions (HSC §38571). The criteria developed will ensure that the reductions are quantified accurately and are not double-counted within the system.

Offsets can provide regulated entities a source of low-cost emissions reductions. Reductions from compliance offset projects must be quantified using rigorous measurement and enforcement protocols that provide a basis to determine whether the reductions are also additional, i.e., beyond what would have happened in the absence of the offset project. Establishing that reductions are additional is one of the major challenges in establishing the validity of particular offset projects. Once a project can quantify emissions using an approved methodology, the reductions of emissions must be verified to ensure that reductions actually occurred.

While some offsets provide benefits, allowing unlimited offsets would reduce the amount of reductions of greenhouse gas emissions occurring within the sectors covered by the cap-and-trade program. This could reduce the local economic, environmental and public health co-benefits and delay the transition to low-carbon energy systems within the capped sectors that will be necessary to meet our long term climate goals. The limit on the use of offsets and allowances from other systems within the WCI Partner jurisdiction program design assures that a majority of the emissions reductions required from 2012 to 2020 occur at entities and facilities covered by the cap and trade program. Consequently, the use of offsets and allowances from other systems are limited to no more than 49 percent of the required reduction of emissions. This quantitative limit will help provide balance between the need to achieve meaningful emissions reductions from capped sources with the need to provide sources within capped sectors the opportunity for low-cost reduction opportunities that offsets can provide. The WCI offset program may incorporate flexibility to use offsets and non-WCI allowances across the three compliance periods, which each WCI Partner jurisdiction could use at its discretion. ARB will apply the limit on offsets that is within its jurisdiction, such that the allowable offsets in each compliance period is less than half of the emissions reductions expected from capped sectors in that compliance period. Each WCI Partner jurisdiction may choose to adopt a more stringent limit on the use of offsets and non-WCI allowances.

Offsets can also encourage the spread of clean, low carbon technologies outside California. High quality offset projects located outside the state can help lower the compliance costs for regulated entities in California, while reducing greenhouse gas emissions in areas that would otherwise lack the resources needed to do so. International projects may also have significant environmental, economic and social benefits. Projects in the Mexican border region may be of particular interest, considering the opportunity to realize considerable co-benefits on both sides of the border. The Governor has recently signed a Memorandum of Understanding with the

six Mexican border states that calls for cooperation on the development of project protocols for Mexican greenhouse gas emissions reduction projects.[30] Additionally, defining project types related to imported commodities (such as cement) would enable California to provide incentives to reduce emissions associated with products that are imported into the state for our consumption.

California is committed to working at the international level to reduce greenhouse gas emissions globally and finding ways to support the adoption of low-carbon technologies and sustainable development in the developing world. ARB will work with WCI Partner jurisdictions and within the rulemaking process to establish an offsets program without geographic restrictions that includes sufficiently stringent criteria for creating offset credits to ensure the overall environmental integrity of the program.

One concept being evaluated for accepting offsets from the developing world is to limit offsets to those jurisdictions that demonstrate performance in reducing emissions and/or achieving greenhouse gas intensity targets in certain carbon intensive sectors (e.g., cement), or in reducing emissions or enhancing sequestration through eligible forest carbon activities in accordance with appropriate national or sub-national accounting frameworks. This could be achieved through an agreement to work jointly to develop minimum performance standards or sectoral benchmarks, backed by appropriate monitoring and accounting frameworks. Such agreements would encourage early action in developing countries toward binding commitments, and could also reduce concerns about competitiveness and risks associated with carbon leakage.

2. California Light-Duty Vehicle Greenhouse Gas Standards

Implement adopted Pavley standards and planned second phase of the program. Align zero-emission vehicle, alternative and renewable fuel and vehicle technology programs with long-term climate change goals.

Passenger vehicles are responsible for almost 30 percent of California's greenhouse gas emissions. To address these emissions, ARB is proposing a comprehensive three-prong strategy – reducing greenhouse gas emissions from vehicles, reducing the carbon content of the fuel these vehicles burn, and reducing the miles these vehicles travel. Transportation fuels and regional transportation-related greenhouse gas targets are discussed later in the recommendations.

There are a number of efforts intended to reduce greenhouse gas emissions from California's passenger vehicles, including the Pavley greenhouse gas vehicle

[30] Memorandum of Understanding on Environmental Cooperation between the California Environmental Protection Agency, the California Department of Food and Agriculture and the California Resources Agency of the State of California, United States of America and the Ministry of Environment and Natural Resources of the United Mexican States. February 13, 2008. http://gov.ca.gov/pdf/press/021308_MOU_English.pdf (accessed October 12, 2008)

standards to achieve near-term emission reductions, the zero-emission vehicle (ZEV) program to transform the future vehicle fleet, and the Alternative and Renewable Fuel and Vehicle Technology Program created by AB 118 (Núñez, Chapter 750, Statutes of 2007).

Pavley Greenhouse Gas Vehicle Standards

AB 1493 (Pavley, Chapter 200, Statutes of 2002) directed ARB to adopt vehicle standards that lowered greenhouse gas emissions to the maximum extent technologically feasible, beginning with the 2009 model year. ARB adopted regulations in 2004 and applied to the U.S. Environmental Protection Agency (U.S. EPA) for a waiver under the federal Clean Air Act to implement the regulation. The Pavley regulations incorporate both performance standards and market-based compliance mechanisms. To obtain additional reductions from the light duty fleet, ARB plans to adopt a second, more stringent, phase of the Pavley regulations. Table 6 summarizes the estimated reduction of emissions for the Pavley regulations. In addition to delivering greenhouse gas emissions reductions, the standards will save money for Californians who purchase vehicles that comply with the Pavley standards – an estimated average of $30 each month in avoided fuel costs.

To date, 13 other states have adopted California's existing greenhouse gas standards for vehicles. Under federal law, California is the only state allowed to adopt its own vehicle standards (though other states are permitted to adopt California's more rigorous standards), but California cannot implement the regulations until U.S. EPA grants an administrative waiver. In December 2007, U.S. EPA denied California's waiver request to implement the Pavley regulations. California and others are challenging that denial in Federal court. The regulations have also been challenged by the automakers in federal courts, although to date, those challenges have been unsuccessful.

ARB is evaluating the use of feebates as a measure to achieve additional reductions from the mobile source sector, either as a backstop to the Pavley regulation if the regulation cannot be implemented, or as a supplement to Pavley if the waiver is approved and the regulation takes effect. AB 32 specifically states that if the Pavley regulations do not remain in effect, ARB shall implement alternative regulations to control mobile sources to achieve equivalent or greater reductions of greenhouse gas emissions (HSC §38590). ARB is currently evaluating the use of a feebate program as the mechanism to secure these reductions. A feebate regulation would combine a rebate program for low-emitting vehicles with a fee program for high-emitting vehicles. This program would be designed in a way to generate equivalent or greater cumulative reductions of greenhouse gas emissions compared to what would have been achieved under the Pavley regulations. ARB would also evaluate the potential to expand the program to include additional vehicle classes not currently included in the Pavley program for further greenhouse gas benefits.

If the U.S. EPA grants California's request for a waiver to proceed with implementation of the Pavley regulations, we will analyze the potential for pursuing a

feebate program that could complement the Pavley regulations and achieve additional reductions of greenhouse gas emissions.

Zero-Emission Vehicle Program

The Zero Emission Vehicle (ZEV) program will play an important role in helping California meet its 2020 and 2050 greenhouse gas emissions reduction requirements. Through 2012, the program requires placement of hundreds of ZEVs (including hydrogen fuel cell and battery electric vehicles) and thousands of near-zero emission vehicles (plug-in hybrids, conventional hybrids, compressed natural gas vehicles). In the mid-term (2012-2015), the program will require placement of increasing numbers of ZEVs and near-zero emission vehicles in California. In 2009, the Board will consider a proposal that is currently being developed to ensure that the ZEV program is optimally designed to help the State meet its 2020 target and put us on the path to meeting our 2050 target of an 80 percent reduction in greenhouse gas emissions.

It is important to note that while the use of both battery-powered electric vehicles and plug-in hybrids (which can be plugged in to recharge batteries) is not expected to increase electricity demand in the near term, over the longer term these technologies could result in meaningful new electricity demand. However, the expected increased electricity demand is likely to be met by off peak vehicle battery charging (i.e., overnight) to provide a means of load leveling and other possible benefits.[31]

Air Quality Improvement Program/Alternative and Renewable Fuel and Vehicle Technology Program

Under AB 118 (Núñez, Chapter 750, Statutes of 2007), ARB is administering the Air Quality Improvement Program, which provides approximately $50 million per year for grants to fund clean vehicle/equipment projects and research on the air quality impacts of alternative fuels and advanced technology vehicles.

AB 118 also created the Alternative and Renewable Fuel and Vehicle Technology Program and authorized CEC to spend up to $120 million per year for over seven years (from 2008-2015) to develop, demonstrate, and deploy innovative technologies to transform California's fuel and vehicle types. This program creates the opportunities for investment in technologies and fuels that will help meet the Low Carbon Fuel Standard, the AB 1007 (Pavley, Chapter 371, Statutes of 2005) goal of increasing alternative fuels, the AB 32 goal of reducing greenhouse gas emissions to 1990 levels by 2020, and the State's overall goal of reducing greenhouse gas emissions 80 percent below 1990 levels by 2050. CEC and ARB are coordinating closely in the implementation of AB 118. In the long-term, programs to reduce greenhouse gas emissions from cars would reduce highway funds because less fuel would be sold, reducing tax revenue. In coordination with other State agencies, ARB

[31] There is also a potential for battery-electric and hybrid vehicles (both plug-in and traditional hybrid-electric) to be used in the future to provide electricity back into the electricity grid during times of especially high demand (peak periods).

will continue to evaluate the potential impacts of these shifts and identify potential solutions.

Table 6: California Light-Duty Vehicle Greenhouse Gas Standards Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-1	Pavley I and II – Light-Duty Vehicle Greenhouse Gas Standards	31.7
	Total	**31.7**

3. Energy Efficiency

Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly-owned utilities).

Energy-efficiency measures for both electricity and natural gas can reduce greenhouse gas emissions significantly. In 2003, the CPUC and CEC adopted an Energy Action Plan that prioritized resources for meeting California's future energy needs, with energy efficiency being first in the "loading order," or highest priority. Since then, this policy goal has been codified into statute through legislation that requires electric utilities to meet their resource needs first with energy efficiency.[32]

This measure would set new targets for statewide annual energy demand reductions of 32,000 gigawatt hours and 800 million therms from business as usual[33] – enough to power more than 5 million homes, or replace the need to build about ten new large power plants (500 megawatts each). These targets represent a higher goal than existing efficiency targets established by CPUC for the investor-owned utilities due to the inclusion of innovative strategies above traditional utility programs. Achieving the State's energy efficiency targets will require coordinated efforts from the State, the federal government, energy companies and customers. ARB will work with CEC and CPUC to facilitate these partnerships. A number of these measures also have the potential to deliver significant economic benefits to California consumers, including low-income households and small businesses. California's energy efficiency programs for buildings and appliances have generated more than $50 billion in

[32] SB 1037 (Kehoe, Chapter 366, Statutes of 2005) and AB 2021 (Levine, Chapter 734, Statutes of 2006) directed electricity corporations subject to CPUC's authority and publicly-owned electricity utilities to first meet their unmet resource needs through all available energy efficiency and demand response resources that are cost effective, reliable and feasible.

[33] The savings targeted here are additional to savings currently assumed to be incorporated in CEC's 2007 demand forecasts. However, CEC has initiated a public process to better determine the quantity of energy savings from standards, utility programs, and market effects that are embedded in the baseline demand forecast.

savings over the past three decades. Tables 7 and 8 summarize the reduction of greenhouse gas emissions.

Efficiency

Achieving the energy efficiency target will require redoubled efforts to target industrial, agricultural, commercial, and residential end-use sectors, comprised of both innovative new initiatives that have been embraced by CEC's energy policy reports and CPUC's long-term strategic plan, and improvements to California's traditional approaches of improved building standards and utility programs.

High-efficiency distributed generation applications like fuel cell technologies can also play an important role in helping the State meet its requirements for reduction of greenhouse gas emissions. Key energy efficiency strategies, grouped by type, include:

Cross-cutting Strategy for Buildings

- "Zero Net Energy" buildings[34]

Codes and Standards Strategies

- More stringent building codes and appliance efficiency standards
- Broader standards for new types of appliances and for water efficiency
- Improved compliance and enforcement of existing standards
- Voluntary efficiency and green building targets beyond mandatory codes

Strategies for Existing Buildings

- Voluntary and mandatory whole-building retrofits for existing buildings
- Innovative financing to overcome first-cost and split incentives for energy efficiency, on-site, renewables, and high efficiency distributed generation

Existing and Improved Utility Programs

- More aggressive utility programs to achieve long-term savings

Other Needed Strategies

- Water system and water use efficiency and conservation measures
- Local government programs that lead by example and tap into local authority over planning, development, and code compliance
- Additional industrial and agricultural efficiency initiatives
- Providing real time energy information technologies to help consumers conserve and optimize energy performance

With the support of key State agencies, utilities, local governments and others, the CPUC has recently adopted the *California Long Term Energy Efficiency Strategic*

[34] Zero net energy refers to building energy use over the course of a typical year. When the building is producing more electricity than it needs, it exports its surplus to the grid. When the building requires more electricity than is being produced on-site, it draws from the grid. Generally, when constructing a ZNE building, energy efficiency measures can result in up to 70% savings relative to existing building practices, which then allows for renewables to meet the remaining load.

Plan.[35] Released September 2008, this Plan sets forth a set of strategies toward maximizing the achievement of cost-effective energy efficiency in California's Electricity and Natural Gas sectors between 2009 and 2020, and beyond. Its recommendations are the result of a year-long collaboration by energy experts, utilities, businesses, consumer groups, and governmental organizations in California, throughout the west, nationally and internationally.

For many of the above goals and others, the Strategic Plan discusses practical implementation strategies, detailing necessary partnerships among the state, its utilities, the private sector, and other market players and timelines for near-term, mid-term and long-term success. While the Strategic Plan is the most current and innovative summary of energy efficiency strategies needed to meet State goals, additional planning and new strategies will likely be needed, both to achieve the 2020 emissions reduction goals and to set the State on a trajectory toward 2050.

Other innovative approaches could also be used to motivate private investment in efficiency improvements. One example that will be evaluated during the development of the cap-and-trade program is the creation of a mechanism to make allowances available within the program to provide incentives for local governments, third party providers, or others to pursue projects to reduce greenhouse gas emissions, including the bundling of energy efficiency improvements for small businesses or in targeted communities.

Solar Water Heating

Solar water heating systems offer a potential for natural gas savings in California. A solar water heating system offsets the use of natural gas by using the sun to heat water, typically reducing the need for conventional water heating by about two-thirds. Successful implementation of the zero net energy target for new buildings will require significant growth in California's solar water heating system manufacturing and installation industry. The State has initiated a program to move toward a self sustaining solar water heater industry. The Solar Hot Water and Efficiency Act of 2007 (SHWEA) authorized a ten year, $250-million incentive program for solar water heaters with a goal of promoting the installation of 200,000 systems in California by 2017.[36]

Combined Heat and Power

Combined heat and power (CHP), also referred to as cogeneration, produces electricity and useful thermal energy in an integrated system. The widespread development of efficient CHP systems would help displace the need to develop new, or expand existing, power plants. This measure sets a target of an additional

[35] California Public Utilities Commission. *California Long Term Energy Efficiency Strategic Plan*. September 2008. http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf (accessed October 12, 2008).

[36] Established under Assembly Bill 1470 (Huffman, Chapter 536, Statues of 2007).

4,000 MW of installed CHP capacity by 2020, enough to displace approximately 30,000 GWh of demand from other power generation sources.[37]

California has supported CHP for many years, but market and other barriers continue to keep CHP from reaching its full market potential. Increasing the deployment of efficient CHP will require a multi-pronged approach that includes addressing significant barriers and instituting incentives or mandates where appropriate. These approaches could include such options as utility-provided incentive payments, the creation of a CHP portfolio standard, transmission and distribution support payments, or the use of feed-in tariffs.

Table 7: Energy Efficiency Recommendation - Electricity
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards • Additional Efficiency and Conservation Programs	15.2
E-2	Increase Combined Heat and Power Use by 30,000 GWh	6.7
	Total	**21.9**

Table 8: Energy Efficiency Recommendation - Commercial and Residential
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
CR-1	Energy Efficiency (800 Million Therms Reduced Consumption) • Utility Energy Efficiency Programs • Building and Appliance Standards • Additional Efficiency and Conservation Programs	4.3
CR-2	Solar Water Heating (AB 1470 goal)	0.1
	Total	**4.4**

4. Renewables Portfolio Standard

Achieve 33 percent renewable energy mix statewide.

CEC estimates that about 12 percent of California's retail electric load is currently met with renewable resources. Renewable energy includes (but is not limited to) wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. California's current Renewables Portfolio Standard (RPS) is intended to

[37] Accounting for avoided transmission line losses of seven percent, this amount of CHP would actually displace 32,000 GWh from the grid.

increase that share to 20 percent by 2010. Increased use of renewables will decrease California's reliance on fossil fuels, thus reducing emissions of greenhouse gases from the Electricity sector. Based on Governor Schwarzenegger's call for a statewide 33 percent RPS, the Plan anticipates that California will have 33 percent of its electricity provided by renewable resources by 2020, and includes the reduction of greenhouse gas emissions based on this level.

Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006) obligates the investor-owned utilities (IOUs) to increase the share of renewables in their electricity portfolios to 20 percent by 2010. Meanwhile, the publicly-owned utilities (POUs) are encouraged but not required to meet the same RPS. The governing boards of the state's three largest POUs, the Los Angeles Department of Water and Power (LADWP), the Sacramento Municipal Utility District (SMUD), and the Imperial Irrigation District (IID), have adopted policies to achieve 20 percent renewables by 2010 or 2011. LADWP and IID have established targets of 35 and 30 percent, respectively, by 2020.

In 2005, CEC and CPUC committed in the Energy Action Plan II to "evaluate and develop implementation paths for achieving renewable resource goals beyond 2010, including 33 percent renewables by 2020, in light of cost-benefit and risk analysis, for all load serving entities." The proposed opinion in the CPUC/CEC joint proceeding lends strong support for obtaining 33 percent of California's electricity from renewables, and states the two Commissions' belief that this target is achievable if the State commits to significant investments in transmission infrastructure and key program augmentation. As with the energy efficiency target, achieving the 33 percent goal will require broad-based participation from many parties and the removal of barriers. CEC, CPUC, California Independent System Operator (CAISO), and ARB are working with California utilities and other stakeholders to formally establish and meet this goal.

A key prerequisite to reaching a target of 33 percent renewables will be to provide sufficient electric transmission lines to renewable resource zones and system changes to allow integration of large quantities of intermittent wind and solar generation. The Renewable Energy Transmission Initiative (RETI) is a broad collaborative of State agencies, utilities, the environmental community, and renewable generation developers that are working cooperatively to identify and prioritize renewable generation zones and associated transmission projects. Although biomass, geothermal, and small-scale hydroelectric generation can provide steady baseload power, other renewable generation is intermittent (wind) or varies over time (solar). Therefore, integration of intermittent generation into the electricity system will require grid improvements so that fluctuations in power availability can be accommodated. Improved communications technology, automated demand response, electric sub-station improvements and other modern technologies must be implemented both to facilitate intermittent renewables, and to improve grid reliability.

Another key action that may help to achieve the renewable energy goals is to reduce the complexity and cost faced by small renewable developers in contracting with utilities to supply renewable generation. This is particularly important for projects offering below 20 megawatts of generation capacity. One such option may be a feed-in tariff for all RPS-eligible renewable energy facilities up to 20 megawatts in size. This mechanism was recommended in CEC's 2007 Integrated Energy Policy Report. Such a tariff, set at an appropriate level, could benefit small-scale facilities by allowing them to be brought into the electricity grid more rapidly.

For the purposes of calculating the reduction of greenhouse gas emissions in this Scoping Plan, ARB is counting emissions avoided by increasing the percentage of renewables in California's electricity mix from the current level of 12 percent to the 33 percent goal, as shown in Table 9.

Table 9: Renewables Portfolio Standard Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
E-3	Achieve a 33% renewables mix by 2020	21.3
	Total	**21.3**

5. Low Carbon Fuel Standard

Develop and adopt the Low Carbon Fuel Standard.

Because transportation is the largest single source of greenhouse gas emissions in California, the State is taking an integrated approach to reducing emissions from this sector. Beyond including vehicle efficiency improvements and lowering vehicle miles traveled, the State is proposing to reduce the carbon intensity of transportation fuels consumed in California.

To reduce the carbon intensity of transportation fuels, ARB is developing a Low Carbon Fuel Standard (LCFS), which would reduce the carbon intensity of California's transportation fuels by at least ten percent by 2020 as called for by Governor Schwarzenegger in Executive Order S-01-07.

LCFS will incorporate compliance mechanisms that provide flexibility to fuel providers in how they meet the requirements to reduce greenhouse gas emissions. The LCFS will examine the full fuel cycle impacts of transportation fuels and ARB will work to design the regulation in a way that most effectively addresses the issues raised by the Environmental Justice Advisory Committee and other stakeholders. ARB identified the LCFS as a Discrete Early Action item, and is developing a regulation for Board consideration in March 2009. A 10 percent reduction in the intensity of transportation fuels is expected to equate to a reduction of 16.5 MMTCO$_2$E in 2020. However, in order to account for possible overlap of

benefits between LCFS and the Pavley greenhouse gas standards, ARB has discounted the contribution of LCFS to 15 $MMTCO_2E$.

Table 10: Low Carbon Fuel Standard Recommendation
($MMTCO_2E$ in 2020)

Measure No.	Measure Description	Reductions
T-2	Low Carbon Fuel Standard (Discrete Early Action)	15
	Total	**15**

6. Regional Transportation-Related Greenhouse Gas Targets

Develop regional greenhouse gas emissions reduction targets for passenger vehicles.

Establishment of Regional Targets

On September 30, 2008, Governor Arnold Schwarzenegger signed Senate Bill 375 (Steinberg) which establishes mechanisms for the development of regional targets for reducing passenger vehicle greenhouse gas emissions. Through the SB 375 process, regions will work to integrate development patterns and the transportation network in a way that achieves the reduction of greenhouse gas emissions while meeting housing needs and other regional planning objectives. This new law reflects the importance of achieving significant additional reductions of greenhouse gas emissions from changed land use patterns and improved transportation to help achieve the goals of AB 32.

SB 375 requires ARB to develop, in consultation with metropolitan planning organizations (MPOs), passenger vehicle greenhouse gas emissions reduction targets for 2020 and 2035 by September 30, 2010. It sets forth a collaborative process to establish these targets, including the appointment by ARB of a Regional Targets Advisory Committee to recommend factors to be considered and methodologies for setting greenhouse gas emissions reduction targets. SB 375 also provides incentives – relief from certain California Environmental Quality Act (CEQA) requirements for development projects that are consistent with regional plans that achieve the targets.

Reaching the Targets

Transportation planning is done on a regional level in major urban areas, through the Metropolitan Planning Organizations. These MPOs are required by the federal government to prepare regional transportation plans (RTPs) in order to receive federal transportation dollars. These plans must reflect the land uses called out in city and county general plans. Regional planning efforts provide an opportunity for community residents to help select future growth scenarios that lead to more sustainable and energy efficient communities. Such plans should be developed through an extensive public process to provide for local accountability.

SB 375 requires MPOs to prepare a sustainable communities strategy to reach the regional target provided by ARB. MPOs would use the sustainable communities strategy for the land use pattern underlying the region's transportation plan. If the strategy does not meet the target, the MPO must document the impediments and show how the target could be met with an alternative planning strategy. The CEQA relief would be provided to those projects that are consistent with either the sustainable communities strategy or alternative planning strategy, whichever meets the target.

Many regions in California have conducted comprehensive scenario planning, called Blueprint planning, that engages a broad set of stakeholders at the local level on the impacts of land use and transportation choices. The State has allocated resources to initiate or augment existing Blueprint efforts of MPOs. These efforts focus on fostering efficient land use patterns that not only reduce vehicle travel but also accommodate an adequate supply of housing, reduce impacts on valuable habitat and productive farmland, increase resource use efficiency, and promote a prosperous regional economy. Blueprint planning can play an important role in the SB 375 process by helping inform target-setting efforts and building strong sustainable communities strategies.

Local governments will play a significant role in the regional planning process to reach passenger vehicle greenhouse gas emissions reduction targets. Local governments have the ability to directly influence both the siting and design of new residential and commercial developments in a way that reduces greenhouse gases associated with vehicle travel, as well as energy, water, and waste. A partnership of local and regional agencies is needed to create a sustainable vision for the future that accommodates population growth in a carbon efficient way while meeting housing needs and other planning goals. Integration of the sustainable communities strategies or alternative planning strategies with local general plans will be key to the achievement of these goals. State, regional, and local agencies must work together to prioritize and create the supporting policies, programs, incentives, guidance, and funding to assist local actions to help ensure regional targets are met.

Enhanced public transit service combined with incentives for land use development that provides a better market for public transit will play an important role in helping to reach regional targets.

SB 375 maintains regions' flexibility in the development of sustainable communities strategies. There are many different ways regions can plan and work toward reducing the growth in vehicle travel. Increasing low-carbon travel choices (public transit, carpooling, walking and biking) combined with land use patterns and infrastructure that support these low-carbon modes of travel, can decrease average vehicle trip lengths by bringing more people closer to more destinations. The need for integrated strategies is supported by the current transportation and land use modeling literature.

Supporting measures that should be considered in both the regional target-setting and sustainable communities strategy processes include the following:

- Congestion pricing strategies can provide a method of efficiently managing traffic demand while raising funds for needed transit, biking and pedestrian infrastructure investment. Regional and local agencies, however, do not have the authority to pursue these strategies on their own, as federal approval and State authorization must be provided for regional implementation of most pricing measures.

- Indirect source rules for new development have already been implemented by some local air districts and proposed by others for purposes of criteria pollution reduction. Regions should evaluate the need for measures that would ensure the mitigation of high carbon footprint development outside of the sustainable communities strategies or alternative planning strategies that meet the targets established under SB 375.

- Programs to reduce vehicle trips while preserving personal mobility, such as employee transit incentives, telework programs, car sharing, parking policies, public education programs and other strategies that enhance and complement land use and transit strategies can be implemented and coordinated by regional and local agencies and stakeholder groups.

Another way to encourage greenhouse gas reductions from vehicle travel is through pay as you drive insurance (PAYD), a structure in which drivers realize a direct financial benefit from driving less. The California Insurance Commissioner recently announced support for PAYD and has proposed regulations to permit PAYD on a voluntary basis.

Separate emissions reduction estimates for these strategies are not quantified here. As regional targets are developed in the SB 375 process, ARB will work with regions to quantify the benefits in the context of the targets.

Estimating the Benefits of Regional Targets

The ARB estimate of the statewide benefit of regional transportation-related greenhouse gas emissions reduction targets is based on analysis of research results quantifying the effects of land use and transportation strategies. The emissions reduction number in Table 11 is not the statewide metric for regional targets that must be developed as SB 375 is implemented. The emissions target will ultimately be determined during the SB 375 process.

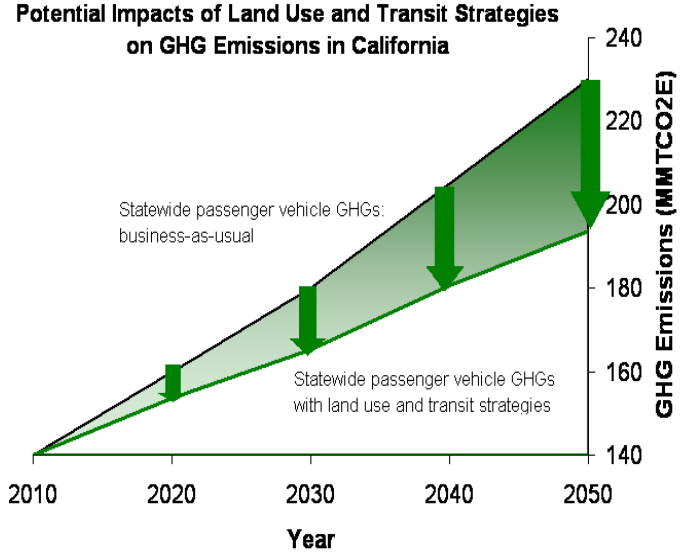
The possible impacts of land use and transportation policies have been well documented. Most recently, a 2008 U.C. Berkeley study[38] reviewed over 20

[38]Rodier, Caroline. U.C. Berkeley, Transportation Sustainability Research Center, "A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions," August 2008. http://www.arb.ca.gov/planning/tsaq/docs/rodier_8-1-08_trb_paper.pdf (accessed October 12, 2008)

modeling studies from California (including the State's four largest MPOs), other states and Europe. The study found a range of 0.4 to 7.7 percent reduction in vehicle miles traveled (VMT) resulting from a combination of land use and enhanced transit policies compared to a business-as-usual case over a 10-year horizon, with benefits doubling by 2030, as shown in Figure 4. With the inclusion of additional measures such as pricing policies, the reduction of greenhouse gas emissions can be greater. These strategies will be considered during the target-setting process. Sophisticated land use and transportation models can best assess these effects. As part of the development of regional targets, technical tools will need to be refined to ensure sound quantification techniques are available.

Figure 4

Potential Impacts of Land Use and Transit Strategies on GHG Emissions in California



The potential benefits of this measure that can be realized by 2020 (as shown in Table 11) were estimated after first accounting for the benefits of the vehicle technology and efficiency measures in the plan. It was calculated based on the U.C. Berkeley study's median value of 4 percent per capita VMT reduction over a 10-year time horizon. This value should not be interpreted as the final estimate of the benefits of this measure. The current academic literature supports this realistic statewide estimate of potential benefits, but the ultimate benefit will be determined as an outcome of SB 375 implementation on a regional level. The incentives for sustainable planning in SB 375 can set California on a new path. ARB's establishment of regional targets in 2010, combined with the Regional Targets Advisory Committee process, required by the legislation, provides a clear mechanism for maximizing the benefits of this measure.

Additional Benefits of Regional Targets and Land Use Strategies

Land use and transportation measures that help reduce vehicle travel will also provide multiple benefits beyond greenhouse gas reductions. Quality of life will be improved

by increasing access to a variety of mobility options such as transit, biking, and walking, and will provide a diversity of housing options focused on proximity to jobs, recreation, and services. Other important state and community goals that could be met through better integrated land use and transportation planning include agricultural, open space and habitat preservation, improved water quality, positive health effects, and the reduction of smog forming pollutants.

Growing more sustainably has the potential to provide additional greenhouse gas and energy savings by encouraging more compact, mixed-use developments resulting in reduced demand for electricity and heating and cooling energy. These land use-related energy savings will contribute toward the Plan's energy efficiency measures to achieve the goal of reducing electricity and natural gas usage. ARB is continuing to evaluate the greenhouse gas emissions reductions that may be additional to the proposed measures in this plan.

Table 11: Regional Transportation-Related Greenhouse Gas Targets Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-3	Regional Transportation-Related Greenhouse Gas Targets[39]	5
	Total	**5**

7. Vehicle Efficiency Measures

Implement light-duty vehicle efficiency measures.

Several additional measures could reduce light-duty vehicle greenhouse gas emissions. The California Integrated Waste Management Board (CIWMB) with various partners continues to conduct a public awareness campaign to promote sustainable tire practices. ARB is pursuing a regulation to ensure that tires are properly inflated when vehicles are serviced. In addition, CEC in consultation with CIWMB is developing an efficient tire program focusing first on data gathering and outreach, then on potential adoption of minimum fuel-efficient tire standards, and lastly on the development of consumer information requirements for replacing tires. ARB is also pursuing ways to reduce engine load via lower friction oil and reducing the need for air conditioner use. ARB is actively engaged in the regulatory development process for the tire inflation component of this measure. Current information indicates the reduction of greenhouse gas emissions is likely to be less than estimated in the Draft Scoping Plan. ARB has adjusted the estimated reductions shown in Table 12 to reflect this.

[39] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB will establish regional targets for each MPO region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

Table 12: Vehicle Efficiency Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-4	Vehicle Efficiency Measures	4.5
	Total	**4.5**

8. Goods Movement

Implement adopted regulations for the use of shore power for ships at berth. Improve efficiency in goods movement activities.

A significant portion of greenhouse gas emissions from transportation activities comes from the movement of freight or goods throughout the state. Activity at California ports is forecast to increase by 250 percent between now and 2020. Both the Goods Movement Emission Reduction Plan (GMERP) and the 2007 State Implementation Plan (SIP) contain numerous measures designed to reduce the public health impact of goods movement activities in California. ARB has already adopted a regulation to require ship electrification at ports. Proposition 1B funds, as well as clean air plans being implemented by California's ports, will also help reduce greenhouse gas emissions while cutting criteria pollutant and toxic diesel emissions. ARB is proposing to develop and implement additional measures to reduce greenhouse gas emissions due to goods movement from trucks, ports and other related facilities. The anticipated reductions would be above and beyond what is already expected in the GMERP and the SIP. This effort should provide accompanying reductions in air toxics and smog forming emissions. The estimated reduction of greenhouse gas emissions is shown in Table 13.

After further evaluation, ARB incorporated the Draft Scoping Plan's Heavy-Duty Vehicle-Efficiency measure into the Goods Movement measure. A Heavy-Duty Engine Efficiency measure could reduce emissions associated with goods movement through improvements which could involve advanced combustion strategies, friction reduction, waste heat recovery, and electrification of accessories. ARB will consider setting requirements and standards for heavy-duty engine efficiency in the future if higher levels of efficiency are not being produced either in response to market forces (fuel costs) or federal standards.

Table 13: Goods Movement Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-5	Ship Electrification at Ports (Discrete Early Action)	0.2
T-6	Goods Movement Efficiency Measures • System-Wide Efficiency Improvements	3.5
	Total	**3.7**

9. Million Solar Roofs Program

Install 3,000 MW of solar-electric capacity under California's existing solar programs.

As part of Governor Schwarzenegger's Million Solar Roofs Program, California has set a goal to install 3,000 megawatts (MW) of new solar capacity by 2017 – moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The Million Solar Roofs Initiative is a ratepayer-financed incentive program aimed at transforming the market for rooftop solar systems by driving down costs over time. Created under Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), the Million Solar Roofs Program includes CPUC's California Solar Initiative and CEC's New Solar Homes Partnership, and requires publicly-owned utilities (POUs) to adopt, implement and finance a solar incentive program. This measure would offset electricity from the grid, thereby reducing greenhouse gas emissions. The estimated emissions reductions are shown in Table 14.

Obtaining the incentives requires the building owners or developers to meet certain efficiency requirements: specifically, that new construction projects meet energy efficiency levels that exceed the State's Title 24 Building Energy Efficiency Standards, and that existing commercial buildings undergo an energy audit. Thus, the program is also a mechanism for achieving the efficiency targets for the Energy sector. By requiring greater energy efficiency for projects that seek solar incentives, the State would be able to reduce both electricity and natural gas needs and their associated greenhouse gas emissions.

Table 14: Million Solar Roofs Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
E-4	Million Solar Roofs (including California Solar Initiative, New Solar Homes Partnership and solar programs of publicly owned utilities) • Target of 3000 MW Total Installation by 2020	2.1
	Total	**2.1**

10. Medium/Heavy-Duty Vehicles

Adopt medium and heavy-duty vehicle efficiency measures.

Medium- and heavy-duty vehicles account for approximately 20 percent of the transportation greenhouse gas inventory. Requiring retrofits to improve the fuel efficiency of heavy-duty trucks could include a requirement for devices that reduce aerodynamic drag and rolling resistance. In addition, hybridization of medium- and

heavy-duty vehicles would also reduce greenhouse gas emissions through increased fuel efficiency. Hybrid trucks would likely achieve the greatest benefits in urban, stop-and-go applications, such as parcel delivery, utility services, transit, and other vocational work trucks. The recommendation for this sector is summarized in Table 15.

Table 15: Medium/Heavy-Duty Vehicle Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-7	Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction Measure - Aerodynamic Efficiency (Discrete Early Action)	0.9
T-8	Medium/Heavy-Duty Vehicle Hybridization	0.5
	Total	**1.4**

11. Industrial Emissions

Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce greenhouse gas emissions and provide other pollution reduction co-benefits. Reduce greenhouse gas emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.

Energy Efficiency and Co-Benefits Audits for Large Industrial Sources

This measure would apply to the direct greenhouse gas emissions at major industrial facilities emitting more than 0.5 MMTCO$_2$E per year. In general, these facilities also have significant emissions of criteria air pollutants, toxic air pollutants, or both. Major industrial facilities include power plants, refineries, cement plants, and miscellaneous other sources. ARB would implement this measure through a regulation, requiring each facility to conduct an energy efficiency audit of individual combustion and other direct sources of greenhouse gases within the facility to determine the potential reduction opportunities, including criteria air pollutants and toxic air contaminants. The audit would include an assessment of the impacts of replacing or upgrading older, less efficient units such as boilers and heaters, or replacing the units with combined heat and power (CHP) units. The measure is summarized in Table 16.

The audit would help ARB to identify potential reductions of greenhouse gas emissions reductions, the associated costs and cost-effectiveness, their technical feasibility, and the potential to reduce air pollution impacts at the local or regional level. ARB will use the results to determine if certain emissions sources within a facility can make cost-effective reductions of greenhouse gas emissions that also provide reductions in other criteria or toxic pollutants. Where this is the case, rule provisions or permit conditions would be considered to ensure the best combination

of pollution reductions. Nothing in this measure would delay known cost-effective strategies that otherwise would be required.

The California Long Term Energy Efficiency Strategic Plan (CPUC) discusses a number of strategies associated with improving industrial sector efficiency and greenhouse gas emissions reductions, including the development of certification protocols for industrial efficiency improvements to develop market recognition for efficiency gains.

Oil and Gas Recovery Operations and Transmission/Refineries

California is a major oil and gas producer. Crude oil, both from in-state and imported sources, is processed at 21 oil refineries in the state. In addition to conforming to the requirements of the cap-and-trade program and the audit measure, ARB has identified four specific measures for development and implementation, two for oil and gas recovery operations and gas transmission, and two for refineries. Other industrial measures that were under consideration affect greenhouse gas emissions sources that are fully regulated under cap and trade, which ARB concluded would provide cost-effective reductions of greenhouse gas emissions. All measures would be designed to secure a combination of cost-effective reductions in greenhouse gas emissions, criteria air pollutants and air toxics. Two measures would be developed to reduce methane emissions in the oil and gas production and gas transmission processes from leaks and incomplete combustion of methane (used as fuel). These measures would include improved leak detection, process modifications, equipment retrofits, installation of new equipment, and best management practices. The first measure would affect oil and gas producers. The second would impact operators of natural gas pipeline systems. These fugitive emissions are not proposed to be covered by a cap and trade program, although combustion-related emissions from these operations are proposed to be covered. The WCI partner jurisdictions are currently evaluating the inclusion of fugitive methane emissions to the extent that adequate quantification methods exist. During implementation of this measure, ARB will determine whether these emissions will also be covered in California's cap-and-trade program. If the emissions are covered under the cap, ARB will evaluate the need for the measures described here.

Two measures would be developed for oil refineries. The first would limit the greenhouse gas emissions from refinery flares while preserving flaring as needed for safety reasons. The second would remove the current fugitive methane exemption in most refinery Volatile Organic Compounds (VOC) regulations. This exemption was established because methane does not appreciably contribute to urban smog, but is inappropriate given the role that methane plays in global warming. ARB believes these measures would provide cost-effective greenhouse gas, criteria pollutants and air toxics emissions reductions. Most combustion and other process emissions at refineries would be governed by the cap-and-trade program. As with the oil and gas production measures above, the need for these measures would be evaluated if fugitive methane is included in the WCI cap-and-trade program.

Table 16: Industrial Emissions Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
I-1	Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	TBD
I-2	Oil and Gas Extraction GHG Emissions Reduction	0.2
I-3	GHG Leak Reduction from Oil and Gas Transmission	0.9
I-4	Refinery Flare Recovery Process Improvements	0.33
I-5	Removal of Methane Exemption from Existing Refinery Regulations	0.01
	Total	**1.4**

12. High Speed Rail

Support implementation of a high speed rail system.

A high speed rail (HSR) system is part of the statewide strategy to provide more mobility choice and reduce greenhouse gas emissions. This measure supports implementation of plans to construct and operate a HSR system between northern and southern California. As planned, the HSR is a 700-mile-long rail system capable of speeds in excess of 200 miles per hour on dedicated, fully-grade separated tracks with state-of-the-art safety, signaling and automated rail control systems. The system would serve the major metropolitan centers of California in 2030 and is projected to displace between 86 and 117 million riders from other travel modes in 2030.

For Phase 1 of the HSR, between San Francisco and Anaheim, 2020 is projected to be the first year of service, with 26 percent of the projected 2030 full system ridership levels. The anticipated reduction of greenhouse gas emissions are shown in Table 17. HSR system ridership and the benefits associated with it are anticipated to increase over time as additional portions of the planned system are completed. Over the long term, the system also has the potential to support the reduction of greenhouse gas emissions in the transportation sector from land use strategies, by providing opportunities for and encouraging low-impact transit-oriented development.

HSR implementation was initiated recently when California voters approved Proposition 1A, the "Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century," as it appeared on the November 2008 ballot. HSR is anticipated to begin in 2010, with full implementation anticipated in 2030.

Table 17: High Speed Rail Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
T-9	High Speed Rail	1.0
	Total	**1.0**

13. Green Building Strategy

Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.

Collectively, energy use and related activities by buildings are the second largest contributor to California's greenhouse gas emissions. Almost one-quarter of California's greenhouse gas emissions can be attributed to buildings.[40] As the Governor recognized in his Green Building Initiative (Executive Order S-20-04), significant reductions in greenhouse gas emissions can be achieved through the design and construction of new green buildings as well as the sustainable operation, retrofitting, and renovation of existing buildings.

A Green Building strategy offers a comprehensive approach to reducing direct and upstream greenhouse gas emissions that cross-cuts multiple sectors including Electricity/Natural Gas, Water, Recycling/Waste, and Transportation. Green buildings are designed, constructed, renovated, operated, and maintained using an integrated approach that reduces greenhouse gas emissions by maximizing energy and resource efficiency. Employing a whole-building design approach can create tremendous synergies that result in multiple benefits at little or no net cost, allowing for efficiencies that would never be possible on an incremental basis.

A Green Building strategy will produce greenhouse gas saving through buildings that exceed minimum energy efficiency standards, decrease consumption of potable water, reduce solid waste during construction and operation, and incorporate sustainable materials. Combined these measures can also contribute to healthy indoor air quality, protect human health and minimize impacts to the environment. A Green Building strategy also includes siting considerations. Buildings that are sited close to public transportation or near mixed-use areas can work in tandem with transportation-related strategies to decrease greenhouse gas emissions that result from that sector.

In July 2008, the California Building Standards Commission (CBSC) adopted the Green Building Standards Code (GBSC) for all new construction in the state. While the current version of the commercial green building code is voluntary, CBSC anticipates adopting a mandatory code in 2011 which will institute minimum environmental performance standards for all occupancies. The Green Building Strategy includes Zero Net Energy (ZNE) goals for new and existing homes and commercial buildings consistent with the recently-adopted California Long Term Energy Efficiency Strategic Plan. ARB encourages local governments to raise the bar by adopting "beyond-code" green building requirements. To assist this effort, State government would develop and regularly tighten voluntary standards, written in GBSC language for easy adoption by local jurisdictions.

[40] Greenhouse gas emission estimates from electricity, natural gas, and water use in homes and commercial buildings.

As we approach the 2020 and 2030 targets for zero energy buildings, these "percent above code" targets must shift to "percent of ZNE" targets. Zero energy new and existing buildings can be an overarching and unifying concept for energy efficiency in buildings, as discussed above (building energy efficiency measures E-1 and CR-1). In order to achieve statewide GHG emission reductions, these targets should be expanded to address other aspects of environmental performance. For example, these targets could be re-framed as a carbon footprint reduction goal for a 35 percent reduction in both energy and water consumption. For commercial buildings, a 2011 target should be established such that a quarter of all new buildings reduce energy and water consumption by at least 25 percent beyond code.

Furthermore, retrofitting existing residential and commercial buildings would achieve substantial greenhouse gas emissions reduction benefits. This Scoping Plan recommends the establishment of an environmental performance rating system for homes and commercial buildings and further recommends that California adopt mechanisms to encourage and require retrofits for buildings that do not meet minimum standards of performance.

An effective green building framework can operate to deliver reductions of greenhouse gas emissions in multiple sectors. The green building strategies provide a vehicle to achieve the statewide electricity and natural gas efficiency targets and lower greenhouse gas emissions from the waste and water transport sectors. Achieving these green building emissions reductions will require coordinated efforts from a broad range of stakeholders, and new financing mechanisms to motivate investment in green building strategies.

Achieving significant greenhouse gas emissions reductions from new and existing buildings will require a combination of green building measures for new construction and retrofits to existing buildings. The State of California will set an example by requiring all new State buildings to exceed existing Green Building Initiative energy goals and achieve nationally-recognized building sustainability standards such as Leadership in Energy and Environmental Design - New Construction (LEED-NC) "Gold" certification. Existing State buildings would also be retrofitted to achieve higher standards equivalent to LEED-EB for existing buildings (EB) "Silver." All new schools should be required to meet the Collaborative for High Performance Schools (CHPS) 2009 criteria. Existing schools applying for modernization funds should also be required to meet CHPS 2009 criteria.

ARB estimates that the greenhouse gas savings from green building measures as approximately 26 $MMTCO_2E$, as shown in Table 18 below. Most of these reductions are accounted for in the Electricity, Waste and Water sectors. Because of this, ARB has assigned all emissions reductions that occur as a result of green building strategies to other sectors for purposes of meeting AB 32 requirements, but will continue to evaluate and refine the emissions from this sector. As such, this strategy will require implementation from various entities within California, including CEC,

PUC, State Architect, and others, each taking the lead in their area of authority and expertise.

Table 18: Green Buildings Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
GB-1	Green Buildings[41]	26
	Total	**26**

14. High Global Warming Potential Gases

Adopt measures to reduce high global warming potential gases.

High global warming potential (GWP) gases pose a unique challenge. Just a few pounds of high GWP materials can have the equivalent effect on global warming as several *tons* of carbon dioxide. For example, the average refrigerator has about a half-pound of refrigerant and about one pound of "blowing agents" used to make the insulating foam. If these gases were released into the atmosphere, they would have a global warming impact equivalent to five metric tons of CO_2.

High GWP chemicals are very common and are used in many different applications such as refrigeration, air conditioning systems, fire suppression systems, and the production of insulating foam. Because these gases have been in use for years, old refrigerators, air conditioners and foam insulation represent a significant "bank" of these materials yet to be released. High GWP gases are released primarily in two ways. The first is through leaking systems, and the second is during the disposal process. Once high GWP materials are released, they persist in the atmosphere for tens or even hundreds of years. Recommended measures to address this growing problem take the form of direct regulations and use of mitigation fees.

ARB identified four Discrete Early Action measures to reduce greenhouse gas emissions from the refrigerants used in car air conditioners, semiconductor manufacturing, air quality tracer studies, and consumer products. ARB has identified additional potential reduction opportunities based on specifications for future commercial and industrial refrigeration, changing the refrigerants used in auto air conditioning systems, and ensuring that existing car air conditioning systems as well as stationary refrigeration equipment do not leak. Recovery and destruction of high GWP materials in the banks described above could also provide significant reductions.

[41] Although some of these emissions reductions may be additional, most of them are accounted for in the Energy, Waste, Water, and Transportation sectors. In addition, some of these reductions may occur out of state, making quantification more difficult. Because of this, these emissions reductions are not currently counted toward the AB 32 2020 goal.

ARB is also proposing to establish an upstream mitigation fee on the use of high GWP gases. Even with the reductions from the specific high GWP measures described above, this sector's emissions are still projected to more than double from current levels by 2020. This is because of the high growth in the sector due, in part, to the replacement of ozone-depleting substances being phased out of production. These emissions would be difficult to address via traditional approaches since the gases are used in small quantities in very diverse applications. Additionally, there are no proven substitutes or alternatives for some uses, and the relative low price of most high GWP compounds provides little incentive to develop alternatives, reduce leakage, or recover the gases at end-of-life.

An upstream fee would ensure that the climate impact of these substances is reflected in the total cost of the product, encouraging reduced use and end-of-life losses, as well as the development of alternatives. The fee would be variable and associated with the impact the product makes on public health and the environment. This could encourage product innovation because fees would correspondingly decrease as the manufacturer or producer redesigned their product or found lower-cost alternatives. This mitigation fee would complement many of the downstream high GWP regulations currently being developed.[42] Fees on high GWP gases would be set to be consistent with the cost of reducing greenhouse gas emissions and could be set to reduce multiple environmental impacts. Revenues could be used to mitigate greenhouse gas emissions either from other high GWP compounds or other greenhouse gases.

Table 19 summarizes the recommendations for measures in the High GWP sector. These measures address both high GWP gases identified in AB 32 and also other high GWP gases, such as ozone-depleting substances that are only partially covered by the Montreal Protocol. The emissions reductions shown are only for the six greenhouse gases explicitly identified in AB 32.

[42] Industrial process emissions of high GWP gases are also expected to be part of the cap-and-trade program. As ARB moves through the rulemaking for both the high GWP fee and the cap-and-trade program, staff will evaluate whether these are complementary approaches or if one or the other needs to be adjusted to prevent duplicative regulation of the industrial process emissions of these gases.

Table 19: High GWP Gases Sector Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
H-1	Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)	0.26
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)	0.15
H-4	Limit High GWP Use in Consumer Products (Discrete Early Action) (Adopted June 2008)	0.25
H-5	High GWP Reductions from Mobile Sources • Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems • Air Conditioner Refrigerant Leak Test During Vehicle Smog Check • Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers • Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	3.3

H-6	High GWP Reductions from Stationary Sources
	• High GWP Stationary Equipment Refrigerant Management Program:
	  o Refrigerant Tracking/Reporting/Repair Deposit Program
	  o Specifications for Commercial and Industrial Refrigeration Systems
	• Foam Recovery and Destruction Program
	• SF_6 Leak Reduction and Recycling in Electrical Applications
	• Alternative Suppressants in Fire Protection Systems
	• Residential Refrigeration Early Retirement Program
		10.9

H-7	Mitigation Fee on High GWP Gases[43]	5
	Total	**20.2**

[43] The 5 MMTCO$_2$E reduction is an estimate of what might occur with a fee in place. Additional emissions reductions from a fee would be expected as resulting revenues are used in mitigation programs. Using the funds to mitigate greenhouse gas emissions could substantially increase the emissions reductions from this measure.

15. Recycling and Waste

Reduce methane emissions at landfills. Increase waste diversion, composting and other beneficial uses of organic materials, and mandate commercial recycling. Move toward zero-waste.

California has a long track record of reducing greenhouse gas emissions by turning waste into resources, exemplified by the waste diversion rate from landfills of 54 percent (which exceeds the current 50 percent mandate) resulting from recovery of recyclable materials. Re-introducing recyclables with intrinsic energy value back into the manufacturing process reduces greenhouse gas emissions from multiple phases of product production including extraction of raw materials, preprocessing and manufacturing. Additionally, by recovering organic materials from the waste stream, and having a vibrant composting and organic materials industry, there is an opportunity to further reduce greenhouse gas emissions through the indirect benefits associated with the reduced need for water and fertilizer for California's Agricultural sector. Incentives may also be an effective way to secure greenhouse gas emissions reductions in this sector. Table 20 summarizes the emissions reductions from Recycling and Waste sector.

Reduction in Landfill Methane

Methane emissions from landfills, generated when wastes decompose, account for one percent of California's greenhouse gas emissions. Greenhouse gas emissions can be substantially reduced by properly managing all materials to minimize the generation of waste, maximize the diversion from landfills, and manage them to their highest and best use. Capturing landfill methane results in greenhouse gas benefits, as well as reductions in other air pollutants such as volatile organic compounds. ARB is working closely with the California Integrated Waste Management Board (CIWMB) to develop a Discrete Early Action measure for landfill methane control that will be presented to ARB in January.

CIWMB is also pursuing efforts to reduce methane emissions by diverting organics from landfills, and to promote best management practices at smaller uncontrolled landfills. Landfill gas may also provide a viable source of liquefied natural gas (LNG) vehicle fuel. Reductions from these types of projects would be accounted for in the Transportation sector.

High Recycling / Zero Waste

This measure reduces greenhouse gas emissions primarily by reducing the substantial energy use associated with the acquisition of raw materials in the manufacturing stage of a product's life-cycle. As virgin raw materials are replaced with recyclables, a large reduction in energy consumption should be realized. Implementing programs with a systems approach that focus on consumer demand, manufacturing, and movement of products will result in the reduction of greenhouse gas emissions and other co-benefits. Reducing waste and materials at the source of generation,

increased use of organic materials to produce compost to benefit soils and to produce biofuels and energy, coupled with increased recycling – especially in the commercial sector – and Extended Producer Responsibility (EPR) plus Environmentally Preferable Purchasing (EPP) also have the potential to reduce emissions, both in-state and within the connected global economy. This measure could also assist in meeting the 33 percent renewables energy goal through deployment of anaerobic digestion for production of fuels/energy.

As noted by ETAAC, recycling in the commercial sector could be substantially increased. This will be implemented through mandatory programs and enhanced partnerships with local governments. The provision of appropriate financial incentives will be critical. ARB will work with CIWMB to develop and implement these types of programs. ARB will also work with CIWMB, the California Department of Food and Agriculture, the Department of Transportation, and others to provide direct incentives for the use of compost in agriculture and landscaping. Further, CIWMB will explore the use of incentives for all Recycling and Waste Management measures, including for commercial recycling and for local jurisdictions to encourage the collection of residentially and commercially-generated food scraps for composting and in-vessel anaerobic digestion.

Table 20: Recycling and Waste Sector Recommendation - Landfill Methane Capture and High Recycling/Zero Waste
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
RW-1	Landfill Methane Control (Discrete Early Action)	1
RW-2	Additional Reductions in Landfill Methane • Increase the Efficiency of Landfill Methane Capture	TBD
RW-3	High Recycling/Zero Waste • Mandatory Commercial Recycling • Increase Production and Markets for Organics Products • Anaerobic Digestion • Extended Producer Responsibility • Environmentally Preferable Purchasing	 5 2 2 TBD TBD
	Total	**10**[44]

[44] Reductions from RW-2 and RW-3 are not counted toward the AB 32 goal. ARB is continuing to work with CIWMB to quantify these emissions and determine what portion of the reductions can be credited to meeting the AB 32 2020 goal. These measures may provide greater emissions reductions than estimated.

16. Sustainable Forests

Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation.

The 2020 Scoping Plan target for California's forest sector is to maintain the current 5 $MMTCO_2E$ of sequestration through sustainable management practices, potentially including reducing the risk of catastrophic wildfire, and the avoidance or mitigation of land-use changes that reduce carbon storage. California's Board of Forestry and Fire Protection has the existing authority to provide for sustainable management practices, and will, at a minimum, work to maintain current carbon sequestration levels. The Resources Agency and its departments will also have an important role to play in implementing this measure.

In addition, the Resources Agency is supporting voluntary actions, including expenditure of public funds for projects focused largely on conserving biodiversity, providing recreation, promoting sustainable forest management and other projects that also provide carbon sequestration benefits. The federal government must also use its regulatory authority to, at a minimum, maintain current carbon sequestration levels for land under its jurisdiction in California.

Forests in California are now a carbon sink. This means that atmospheric removal of carbon through sequestration is greater than atmospheric emissions from processes like fire and decomposition of wood. However, several factors, such as wildfires and forest land conversion, may cause a decline in the carbon sink. The 2020 target would provide a mechanism to help ensure that current carbon stocks are, at a minimum, maintained and do not diminish over time. The 5 $MMTCO_2E$ emission reduction target is set equal to the magnitude of the current estimate of net emissions from California's forest sector. As technical data improve, the target can be recalibrated to reflect new information.

California's forests will play an even greater role in reducing carbon emissions for the 2050 greenhouse gas emissions reduction goals. Forests are unique in that planting trees today will maximize their sequestration capacity in 20 to 50 years. As a result, near-term investments in activities such as planting trees will help us reach our 2020 target, but will also play a greater role in reaching our 2050 goals.

Monitoring carbon sequestered on forest lands will be necessary to implement the target. The Board of Forestry and Fire Protection, working with the Resources Agency, the Department of Forestry and Fire Protection and ARB would be tasked with developing a monitoring program, improving greenhouse gas inventories, and determining what actions are needed to meet the 2020 target for the Forest sector. Future climate impacts will exacerbate existing wildfire and insect disturbances in the Forest sector. These disturbances will create new uncertainties in reducing emissions and maintaining sequestration levels over the long-term, requiring more creative strategies for adapting to these changes. In the short term, focusing on sustainable management practices and land-use issues is a practical approach for moving forward.

Future land use decisions will play a role in reaching our greenhouse gas emissions reduction goals for all sectors. Loss of forest land to development increases greenhouse gas emissions levels because less carbon is sequestered. Avoiding or mitigating such conversions will support efforts to meet the 2020 goal. When significant changes occur, the California Environmental Quality Act is a mechanism providing for assessment and mitigation of greenhouse gas emissions.

Going forward there are a number of forestry-related strategies that can play an important role in California's greenhouse gas emissions reduction efforts. Biomass resources from forest residue will factor into the expansion of renewable energy sources (this is currently accounted for in the Energy sector). Similarly, fuels management strategies have the potential to reduce the risk of catastrophic fires. However, fuels management needs to be evaluated to determine whether, and if so under what circumstances, quantifiable greenhouse gas emission reductions are achieved. Additionally, public investments to purchase and preserve forests and woodlands would also provide greenhouse gas emission reductions that will be accounted for as projects are funded. Urban forest projects can also provide the dual benefit of carbon sequestration and shading to reduce air conditioning load.

Furthermore, the Forest sector currently functions as a source of voluntary reductions that would not otherwise occur and this role could expand even further in the future. ARB has already adopted a methodology to quantify reductions from forest projects, and recently adopted additional quantification methodologies. Table 21 summarizes the emission reductions from the forest measure.

Table 21: Sustainable Forests Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
F-1	Sustainable Forest Target	5
	Total	**5**

17. Water

Continue efficiency programs and use cleaner energy sources to move and treat water.

Water use requires significant amounts of energy. Approximately one-fifth of the electricity and one-third of the non-power plant natural gas consumed in the state are associated with water delivery, treatment and use. Although State, federal, and local water projects have allowed the state to grow and meet its water demands, greenhouse gas emissions can be reduced if we can move, treat, and use water more efficiently. As is the case with energy efficiency, California has a long history of advancing water efficiency and conservation programs. Without this ongoing, critical work,

baseline or business-as-usual greenhouse gas emissions associated with water use would be much higher than is currently the case.

Six greenhouse gas emissions reduction strategies measures are proposed for the Water sector, and are shown in Table 22. Three of the measures target reducing energy requirements associated with providing reliable water supplies and two measures are aimed at reducing the amount of non-renewable electricity associated with conveying and treating water. The final measure focuses on providing sustainable funding for implementing these actions. The greenhouse gas emissions reductions from these measures are indirectly realized through reduced energy requirements and are accounted for in the Electricity and Natural Gas sector.

In addition, a mechanism to make allowances available in a cap-and-trade program could be used to provide additional incentives for local governments, water suppliers, and third party providers to bundle water and energy efficiency improvements. This type of allowance set-aside will be evaluated during the rulemaking for the cap-and-trade program.

ARB recommends a public goods charge for funding investments in water management actions that improve water and energy efficiency and reduce GHG emissions. As noted by the Economic and Technology Advancement Advisory Committee, a public goods charge on water can be collected on water bills and then used to fund end-use water efficiency improvements, system-wide efficiency projects, water recycling, and other actions that improve water and energy efficiency and reduce GHG emissions. Depending on how the fee schedule is developed in a subsequent rulemaking process, a public goods charge could generate $100 million to $500 million. These actions would also have the co-benefit of improving water quality and water supply reliability for customers.

Table 22: Water Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
W-1	Water Use Efficiency	1.4
W-2	Water Recycling	0.3
W-3	Water System Energy Efficiency	2.0
W-4	Reuse Urban Runoff	0.2
W-5	Increase Renewable Energy Production	0.9
W-6	Public Goods Charge	TBD
	Total	**4.8**[45]

[45] Greenhouse gas emission reductions from the water sector are not currently counted toward the 2020 goal. ARB anticipates that a portion of these reductions will be additional to identified reductions in the Electricity sector and is working with the appropriate agencies to refine the electricity/water emissions inventory.

18. Agriculture

In the near-term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020.

Encouraging the capture of methane through use of manure digester systems at dairies can provide emission reductions on a voluntary basis. This measure is also a renewable energy strategy to promote the use of captured gas for fuels or power production. Initially, economic incentives such as marketable emission reduction credits, favorable utility contracts, or renewable energy incentives will be needed. Quantified reductions for this measure (shown in Table 23) are not included in the sum of statewide reductions shown in Table 2 since the initial approach is voluntary. ARB and the California Climate Action Registry worked together on a manure digester protocol to establish methods for quantifying greenhouse gas emissions reductions from individual projects; the Board adopted this protocol in September 2008. The voluntary approach will be re-assessed at the five-year update of the Scoping Plan to determine if the program should become mandatory for large dairies by 2020.

Nitrogen fertilizer, which produces N_2O emissions, is the other significant source of greenhouse gases in the Agricultural sector. ARB has begun a research program to better understand the variables affecting fertilizer N_2O emissions (Phase 1), and based on the findings, will explore opportunities for emission reductions (Phase 2).

There may be significant potential for additional voluntary reductions in the agricultural sector through strategies, such as those recommended by ETAAC. These opportunities include increases in fuel efficiency of on-farm equipment, water use efficiency, and biomass utilization for fuels and power production.

Increasing carbon sequestration, including on working rangelands, hardwood and riparian woodland reforestation, also hold potential as a greenhouse gas strategies. As we evaluate the role that this sector can play in California's emissions reduction efforts, we will explore the feasibility of developing sound quantification protocols so that these and other related strategies may be employed in the future.

Table 23: Agriculture Recommendation
(MMTCO$_2$E in 2020)

Measure No.	Measure Description	Reductions
A-1	Methane Capture at Large Dairies[46]	1.0
	Total	**1.0**

[46] Because the emission reductions from this measure are not required, they are not counted in the total.

D. Voluntary Early Actions and Reductions

Many individual activities that are not currently addressed under regulatory approaches can nevertheless result in cost-effective, real, additional, and verifiable greenhouse gas emissions reductions that will help California meet its 2020 target. Ensuring that appropriate credit is available to these types of emissions reduction projects will also help jump-start a new wave of technologies that will feature prominently in California and the world's long-term efforts to combat climate change. ARB will pursue several approaches that will recognize and reward these types of projects.

1. Voluntary Early Action

ARB is required to design regulations to encourage early action to reduce greenhouse gas emissions, and to provide appropriate recognition or credit for that action. (HSC §38562(b)(1) and (3)) Recognizing and rewarding greenhouse gas emissions reductions that occur prior to the full implementation of the AB 32 program can set the stage for innovation by incentivizing the development and employment of new clean technologies and by generating economic and environmental benefits for California.

In February 2008, ARB adopted a policy statement encouraging the early reductions of greenhouse gas emissions.[47] The policy statement describes a process for interested parties to submit proposed emission quantification methodologies for voluntary greenhouse gas emissions reductions to ARB for review. The intent is to provide a rapid assessment of methodologies for evaluating potential greenhouse gas emissions reduction projects to encourage early actions. Where appropriate, ARB will issue Executive Orders to confirm the technical soundness of the methodologies, and the methodology would be available for use by other parties to demonstrate the creation of voluntary early reductions. ARB is currently in the process of evaluating a number of submitted project methodologies.

ARB will provide appropriate credit for voluntary early reductions that can be adequately quantified and verified through three primary means. First, within the cap-and-trade program, ARB would set aside a certain number of allowances from the first compliance period to use to reward voluntary reductions that occur before 2012. In addition, ARB will assure that the allocation process in the first compliance period does not disadvantage facilities that have made reductions after AB 32 went into effect at the start of 2007 and before 2012.[48] The third approach will be to design

[47] Board Meeting Agenda. California Air Resources Board. February 28, 2008. http://www.arb.ca.gov/board/ma/2008/ma022808.htm (accessed October 12, 2008)

[48] ARB will evaluate whether some reductions that occurred prior to AB 32 going into effect on January 1, 2007, should also receive credit under these rules. For example, many facilities in California registered with the California Climate Action Registry after its creation in 2002 to document early actions to reduce emissions by having a record of entities profiles and baselines. ARB will evaluate what reductions made prior to 2007 should be eligible for credit from the allowance set-aside as part of the cap-and-trade program rulemaking.

other regulations, to the extent feasible, to recognize and reward early action. These approaches are discussed in more detail in Appendix C.

2. Voluntary Reductions

Emissions reduction projects that are not otherwise regulated, covered under an emissions cap, or undertaken as a result of government incentive programs can generate "offsets." These are verifiable reductions whose ownership can be transferred to others. Voluntary offset markets have recently flourished as a way for companies and individuals to offset their own emissions by purchasing reductions outside of their own operations. These sorts of voluntary efforts to reduce greenhouse gas emissions can play an important role in helping the State meet its overall greenhouse gas reduction goals.

ARB will adopt methodologies for quantifying voluntary reductions. (HSC §38571) The Board adopted a methodology for forest projects in October 2007 and for urban forestry and manure digesters in September 2008. The recognition of voluntary reduction or offset methodologies does not in any way guarantee that these offsets can be used for other compliance purposes. The Board would need to adopt regulations to verify and enforce reductions achieved under these or other approved methodologies before they could be used for compliance purposes. (HSC §38571)

Allowance set-asides, in addition to being used to potentially reward voluntary early actions by facilities that will be included in the cap-and-trade program, could also be used to reward voluntary early action at other facilities not covered by the cap and to ensure that voluntary actions, such as voluntary renewable power purchases by individuals, businesses, and others, serve to reduce greenhouse gas emissions under the cap. An early action allowance set-aside could be utilized both by entities that are covered by the cap, and by those who develop emissions reducing projects outside of the cap, or purchase the reductions associated with those projects, and have not sold or used them. Additional discussion of voluntary offsets is included in Appendix C.

E. Use of Allowances and Revenues

Revenues may be generated from the implementation of various proposed components of the Scoping Plan, including by the use of auctions within a cap-and-trade system or through the imposition of more targeted measures, such as a public goods charge on water. These revenues could be used to support AB 32 requirements for greenhouse gas emissions reductions and associated socio-economic considerations. This section summarizes some of the recommendations and ideas that ARB has received to date. As discussed in the description of the cap-and-trade measure above, ARB will seek input from a broad range of experts in an open public process regarding the options for allocation and revenue use under consideration.

The Economic and Technology Advancement Advisory Committee (ETAAC) recommended the creation of a California Carbon Trust as a possible mechanism for using revenues

generated by the program, leveraged with private funds, to further the overall program goals. ETAAC's recommendation is roughly based on the United Kingdom Carbon Trust. The United Kingdom program was established with public funds, but now functions as a stand-alone corporation, providing management and consulting services to corporations and small and medium businesses on reducing greenhouse gas emissions. It also funds innovations in carbon reduction technologies. ETAAC recommended the creation of a similar organization that would use revenue from the sale of carbon allowances or from carbon fees to:

- Fund research, development and demonstration projects,
- Help bring promising and high potential technologies through the often challenging early stages of development and get them to market,
- Manage the early carbon market and mitigate price volatility, purchasing credits and selling them or retiring them as needed,
- Dedicate resources to fund projects to achieve AB 32 Environmental Justice goals, or
- Support a green technology workforce training program.

The most appropriate use for some of the allowances and revenue generated under AB 32 may be to retain it within or return it to the sector from which it was generated. For example, CEC and CPUC specifically recommended that significant portions of the revenue generated from the electricity sector under a cap-and-trade program be used for the benefit of that sector to support investments in renewable energy, efficiency, new energy technology, infrastructure, customer utility bill relief, and other similar programs. In the case of more targeted revenues from a public goods charge, the intent would be to use the funds for program purposes within the sector in which it was raised, for example in the water sector. ARB will seek input from a broad range of experts in an open public process, and will work with other agencies, the WCI partner jurisdictions, and stakeholders to consider the options for use of revenues from the AB 32 program.

Possible uses of allowances and of the revenue generated under the program include:

- **Reducing costs of emissions reductions or achieving additional reductions –** Funding energy efficiency and renewable resource development could lower overall costs to consumers and companies, and provide the opportunity to achieve greater emissions reductions than would otherwise be possible. Program revenues could be used to fund programs directly, or create financial incentives for others. Allowance set-asides could also be used to provide incentives for voluntary renewable power purchases by individuals and businesses, and for increased energy efficiency.
- **Achieving environmental co-benefits –** Criteria and toxic air pollutants create health risks, and some communities bear a disproportionate burden from air pollution. Revenues could be used to enhance greenhouse gas emission reductions that also provide reductions in air and other pollutants that affect public health.

- **Incentives to local governments –** Funding or other incentives to local governments for well-designed land-use planning and infrastructure projects could lead to shorter commutes and encourage walking, bicycling and the use of public transit. Funding of other incentives for local governments could also be used to increase recycling, composting, and to generating renewable energy from anaerobic digestion.
- **Consumer rebates –** Utilities and other businesses could use revenues to support and increase rebate programs to customers to offset some of the cost associated with increased investments in renewable resources and to encourage increased energy efficiency.
- **Direct refund to consumers –** Revenue from the program could be recycled directly back to consumers in a variety of forms including per capita dividends, earned income tax credits, or other mechanisms.
- **Climate change adaptation programs –** Climate change will impact natural and human environments. Program revenues could be used to help the state adapt to the effects of climate change which will be detailed in the State's Climate Adaptation Strategy being prepared by the Resources Agency to be completed in early 2009.
- **Subsidies –** Revenues could be used to reduce immediate cost impacts to covered industries required to make substantial upfront capital investments to reduce greenhouse gas emissions.
- **RD&D funding –** Revenues could be used to support research, development, and deployment of green technologies.
- **Worker transition assistance –** Regulating greenhouse gas emissions will probably shift economic growth to some sectors and green technologies and away from higher carbon intensity industries. Worker training programs could help the California labor force be competitive in these new industries.
- **Administration of a greenhouse gas program –** A portion of revenues could be used to underwrite the State's AB 32 programs and operating costs.
- **Direct emission reductions –** Revenues could be used to purchase greenhouse gas reductions for the sole purpose of retirement, providing direct additional greenhouse gas emission reductions. Potential projects, such as afforestation and reforestation, would both sequester CO_2 and provide other environmental benefits.

Many of the potential uses of revenue would help ARB implement the community benefit section of the AB 32 (HSC §38565) which directs the Board, where applicable and to the extent feasible, to ensure that the greenhouse gas emissions reduction program directs public and private investment toward the most disadvantaged communities in California.

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III. EVALUATIONS

The primary purpose of the Scoping Plan is to develop a set of measures that will provide the maximum technologically feasible and cost-effective greenhouse gas emission reductions. In developing this Plan, ARB evaluated the effect of these measures on California's economy, environment, and public health. This Chapter outlines these analyses.

ARB conducted broad evaluations of the potential impacts of the Scoping Plan, and will conduct more specific evaluations during regulatory development (HSC §38561(d), and HSC §38562(b)). Prior to inclusion of market-based compliance mechanisms in a regulation, to the extent feasible, the Board will consider direct, indirect and cumulative emission impacts, and localized impacts in communities that are already adversely impacted by air pollution (HSC §38570(b)).

Based on the evaluation of the recommendations included in this Plan, implementing AB 32 is expected to have an overall positive effect on the economy. In addition, implementation of the measures in the Recommended Actions section (Chapter II) will reduce statewide oxides of nitrogen (NOx), volatile organic compounds (VOC) and atmospheric particulate matter (PM) emissions primarily due to reduced fuel consumption, with resulting public health benefits. ARB will also work at the measure-specific level to further maximize the public health benefits that can accompany implementation of greenhouse gas emissions reduction strategies. The following sections provide a summary of the ARB evaluations of the recommended measures included in this Scoping Plan. More detailed information on the evaluations and their results are provided in Appendices G and H.

A. Economic Modeling

To evaluate the economic impacts of the Scoping Plan, ARB compared estimated economic activity under a business-as usual (BAU) case to the results obtained when actions recommended in this Plan are implemented. The BAU case is briefly described below. The estimated costs and savings used as model inputs for individual measures are outlined in Appendix G, and additional documentation on the calculation of those costs and savings is provided in Appendix I. All dollar estimates are in 2007 dollars.

Under the BAU case, Gross State Product (GSP) in California is projected to increase from $1.8 trillion in 2007 to almost $2.6 trillion in 2020. The results of our economic analysis indicate that implementation of the Scoping Plan will have an overall positive net economic benefit for the state. Positive impacts are anticipated primarily because the investments motivated by several measures result in substantial energy savings that more than pay back the cost of the investments at expected future energy prices.

The business-as-usual case is a representation of what the State of the California economy will be in the year 2020 assuming that none of the measures recommended in the Scoping Plan are implemented. While a number of the measures in the plan will be implemented as the result of existing federal or State policies and do not require additional regulatory action resulting from the implementation of AB 32, they are not included in the BAU case to ensure that the economic impacts of all of the measures in the Scoping Plan are fully assessed.

The BAU case is constructed using forecasts from the California Department of Finance, the California Energy Commission, and other sources, and is described in more detail in Appendix G. ARB used a conservative estimate of future petroleum price in this analysis, $89 per barrel of oil in 2020. Aspects of the BAU case are subject to uncertainty, for example, the possibility that future energy prices could deviate from those that are included in the BAU case.

1. Macro-economic Modeling Results

Table 24 summarizes the key findings from the economic modeling. Gross State Product, personal income and employment are shown for 2007 and for two cases for 2020, the BAU case and for implementation of the Scoping Plan. For both the BAU case and the Scoping Plan case, Gross State Product increases by almost $800 billion between 2007 and 2020, personal income grows by 2.8 percent per year from $1.5 trillion in 2007 to $2.1 trillion in 2020, and employment grows by 0.9 percent per year from 16.4 million jobs in 2007 to 18.4 million (BAU) or 18.5 million (Scoping Plan) in 2020. The results consistently show that implementing the Scoping Plan will not only significantly reduce California's greenhouse gas emissions, but will also have a net positive effect on California's economic growth through 2020.

Table 24: Summary of Key Economic Findings from Modeling the Scoping Plan Using E-DRAM

Economic Indicator	2007	Business-as-Usual*		Scoping Plan		
		2020	Average Annual Growth	2020	Change from BAU	Average Annual Growth
Gross State Product ($Billion)	1,811	2,586	2.8%	2,593	0.3%	2.8%
Personal Income ($Billion)	1,464	2,093	2.8%	2,109	0.8%	2.8%
Employment (Million Jobs)	16.41	18.41	0.9%	18.53	0.7%	0.9%
Emissions ($MMTCO_2E$)	500**	596	1.4%**	422	-28%	-1.2%**
Carbon Prices (Dollars)	-	-	-	10.00	NA	-

* Business-as-usual is a forecast of the California economy in 2020 without implementation of any of the measures identified in the Scoping Plan.

** Approximate value. ARB is in currently estimating greenhouse gas emissions for 2007.

The macroeconomic modeling results presented here understate the benefits of market-based policies, including the cap-and-trade program. Consequently, our estimate of the economic impact of implementing the Scoping Plan understates the positive impact on the California economy. Nonetheless, using the current best estimates of the costs and savings of the measures, which are documented in Appendix I, the models demonstrate that implementing the Plan will have a positive effect on California's economy.

The modeling results reflect a carbon price for the cap-and-trade program of $10 per-ton. It is important to note that the $10 per-ton figure does not reflect the average cost of reductions; rather it is the *maximum* price at which reductions to achieve the cap are pursued based on the marketing program.

The positive impacts are largely attributable to savings that result from reductions in expenditures on energy. These savings translate into increased consumer spending on goods and services other than energy. Many of the measures entail more efficient use of energy in the economy, with savings that exceed their costs. In this way, investment in energy efficiency results in money pumped back into local economies. Table 25 summarizes the energy savings that are projected from implementation of the Scoping Plan. These savings are estimated to exceed $20 billion annually by 2020.

Table 25: Fuels and Electricity Saved in 2020 from Implementation of the Scoping Plan

	Gasoline	Diesel	Electricity	Natural Gas*
Use Avoided**	4,600 million gallons	670 million gallons	74,000 GWh	3,400 million therms
Value of Avoided Fuel Use (Million $2007)	$17,000	$2,500	$6,400***	$2,700
Percent Reduction from BAU	25%	17%	22%****	24%

* Not including natural gas for electric generation.

** These estimates are based on reduced use of these fuels due to increased efficiencies, reduced vehicle miles travelled, etc. Changes to the fuel mix, such as those called for under the RPS or the LCFS, are not included here. These estimates are not the same as the estimates of reduced fuel consumption used in the public health analysis.

*** Based on estimated avoided cost based on average base-load electricity, including generation, transmission and distribution.

**** This is as a percentage of BAU total California electricity consumption in 2020.

2. Impact on Specific Business Sectors

As indicated in Table 26 and Table 27, the effects of the Plan are not uniform across sectors. Implementation of the Scoping Plan would have the strongest positive impact on output and employment for the agriculture, forestry and fishing sector, the

finance, insurance and real estate sector, and the mining sector. Similar to the statewide economic impacts projected by the model, however, these results also indicate that relative to the business-as-usual case, the impacts due to implementation of the Plan change current growth projections for most sectors by only very small amounts.

Table 26 and Table 27 also show that a decrease in output is projected for the utility and retail trade sectors as compared to the business-as-usual case, and a decrease in employment is projected for the utility sector. In the utility sector, the modeling indicates that implementation of the Scoping Plan would significantly reduce the need for additional power generation and natural gas consumption, which subsequently reduces the growth in output for this sector. This results in a reduction from business-as-usual for economic output and employment of approximately 17 and 15 percent respectively in 2020. The primary reason for these projections is the implementation of efficiency measures and programs for both consumers and producers. While increasing spending on efficiency and renewable energy is expected to increase employment, many of the resulting jobs will not appear in the utility sector.

The retail trade sector, which is projected to grow by nearly 50 percent in both the business-as-usual and the Scoping Plan case, is also projected to experience a slight net decline in output relative to business-as-usual. Since gasoline is considered a consumer retail purchase under this model, the reduced growth is mostly due to the decrease of approximately $19 billion in retail transportation fuel purchases, which is largely offset by the positive $14 billion increase in spending at other retail enterprises.

Table 26: Summary of Economic Output by Sector from Modeling the Scoping Plan Using E-DRAM

Sector	Output ($Billions)			
	2007	Business-as-Usual	Scoping Plan	Percent Change from BAU
Agriculture, Forestry and Fishing	76	109	113	3.9%
Mining	27	29	31	7.2%
Utilities	51	72	60	-16.7%
Construction	114	164	166	1.7%
Manufacturing	673	943	948	0.5%
Wholesale Trade	120	171	173	1.0%
Retail Trade	207	296	291	-1.6%
Transportation and Warehousing	76	109	111	1.9%
Information	164	235	238	1.1%
Finance, Insurance and Real Estate	391	559	572	2.3%
Services	636	910	927	1.9%
Government	-	-	-	-
Total	**2,535**	**3,597**	**3,630**	**0.8%**

Table 27: Summary of Employment Changes by Sector from Modeling the Scoping Plan Using E-DRAM

Sector	Employment (thousands)			
	2007	Business-as-Usual	Scoping Plan	Percent Change from BAU
Agriculture, Forestry and Fishing	398	449	464	3.5%
Mining	26	26	26	1.3%
Utilities	60	67	57	-14.7%
Construction	825	929	934	0.5%
Manufacturing	1,821	2,046	2,057	0.5%
Wholesale Trade	703	791	793	0.1%
Retail Trade	1,688	1,901	1,916	0.8%
Transportation and Warehousing	447	503	510	1.2%
Information	398	448	450	0.4%
Finance, Insurance and Real Estate	911	1,026	1,046	2.0%
Services	5,975	6,729	6,773	0.7%
Government	3,100	3,491	3,502	0.3%
Total	**16,352**	**18,405**	**18,528**	**0.6%**

3. Household Impacts

Implementation of the Scoping Plan will provide low- and middle-income households savings on the order of a few hundred dollars per year in 2020 compared to the business-as-usual case, primarily as a result of increased energy efficiencies.

Low-Income Households: Based on current U.S. Department of Health and Human Services poverty guidelines, we evaluated the projected impacts of the plan on households with earnings at or below both 100 and 200 percent of the poverty guidelines. For all households, including those with incomes at 100 percent and 200 percent of the poverty level, implementation of the Scoping Plan produces a slight increase in per-capita income relative to the business-as-usual case.

At the same time, the analysis projects an increase of approximately 50,000 jobs available for lower-income workers[49] relative to business-as-usual as a result of implementing the Plan. The largest employment gains come in the retail, food service, agriculture, and health care fields. A decline in such jobs is projected in the retail gasoline sector due to the overall projected decrease in output from this sector. This decline, however, is more than offset by the increases experienced in other areas.

Another important factor to consider when analyzing the impact of the Scoping Plan on households is how it will affect household expenditures. As indicated in Table 28, analysis based on the modeling projections estimates a savings (i.e., reduced expenditures) of around $400 per household in 2020 for low-income households under both federal poverty guideline definitions. These savings are driven primarily by the implementation of the clean car standards and energy efficiency measures in the Scoping Plan that over time are projected to outweigh potential increases in electricity and natural gas prices that may occur. As the measures in the Scoping Plan are implemented, ARB will work to ensure that the program is structured so that low income households can fully participate in and benefit from the full range of energy efficiency measures. Many of California's energy efficiency efforts are targeted specifically at low income populations, and the CPUC's Long Term Strategic Plan for energy efficiency has redoubled its objective for the delivery of energy efficiency measures to low income populations. Additional information regarding the data in Table 28 can be found in Appendix G.

[49] Low-income jobs are defined as those with a median hourly wage below $15 per hour (2007 dollars) based on wage data and staffing pattern projections from the California Employment Development Department. The shares of low-wage occupations for each industry are then applied to the corresponding E-DRAM sector employment projections.

Table 28: Impact of Implementation of the Scoping Plan on Total Estimated Household Savings in 2020 (2007 $)

Income at 100% of Poverty Guideline	Income at 200% of Poverty Guideline	Middle Income*	High Income**	All Households***
$400	$400	$500	$500	$500

* All households between 200% and 400% of the poverty guidelines.

** All households above 400% of the poverty guidelines.

*** Average of households of all income levels.

The analysis indicates that implementation of the Scoping Plan is likely to result in small savings for most Californians, with little difference across income levels. Largely due to increased efficiencies, low-income households are projected to be slightly better off from an economic perspective in 2020 as a result of implementing AB 32.

Middle-Income Households: Implementation of the plan produces a small increase in household income across all income levels, including middle-income households, relative to the business-as-usual case.[50] In terms of how jobs for middle-income households[51] would be impacted, the modeling indicates a slight overall increase of almost 40,000 in 2020.

As shown in Table 28, the analysis projects a net-savings in annual household expenditures of about $500 in 2020 for middle-income households. These savings are driven by the emergence of greater energy efficiencies that will be implemented as a result of the plan.

4. WCI Economic Analysis

The Scoping Plan recommends that California develop a cap-and-trade program that links to the broader regional market being developed by the Western Climate Initiative (WCI). In order to examine the economic impacts of WCI program design options, WCI Partner jurisdictions contracted with ICF International and Systematic Solutions, Inc. (SSI) to perform economic analyses using ENERGY 2020, a multi-region, multi-sector energy model. The WCI economic modeling results are reported in full in Appendix D and are discussed in the Background Report on the Design Recommendations for the WCI Regional Cap-and-Trade Program, also included in Appendix D.

To help inform the program design process, the WCI analysis examined the implications of key design decisions, including: program scope, allowance banking,

[50] For purposes of our analysis we define "middle-income" households as those earning between 200% and 400% of the federal poverty guidelines.

[51] Hourly wage between $15 and $30 per hour.

and the use of offsets. Due to time and resource constraints, the modeling was limited to the eight WCI Partner jurisdictions in the Western Electric Coordinating Council (WECC) area, thereby excluding from the analysis three Canadian provinces, Manitoba, Quebec, and Ontario. Future analyses are planned that will integrate these provinces so that a full assessment of the WCI Partner jurisdictions can be performed.

The WCI modeling work is not directly comparable to the ARB results reported here. The WCI analysis relies on a more aggregated set of greenhouse gas emissions reduction measures rather than the specific individual policies recommended in the Scoping Plan; it uses somewhat different assumptions regarding what measures are included in the "business-as-usual" case, and it models the entire WECC rather than California. Nevertheless, the results of the WCI modeling provide useful insight into the economic impact of greenhouse gas emissions reduction policies.

Consistent with the conclusions of the ARB evaluation, overall the WCI analysis found that the WCI Partner jurisdictions can meet the regional goal of reducing emissions to 15 percent below 2005 levels by 2020 (equivalent to the AB 32 2020 target) with small overall savings due to reduced energy expenditures exceeding the direct costs of greenhouse gas emissions reductions. The savings are focused primarily in the residential and commercial sectors, where energy efficiency programs and vehicle standards are expected to have their most significant impacts. Energy-intensive industrial sectors are estimated to have small net costs overall (less than 0.5 percent of output).

The WCI analysis does not examine the potential macroeconomic impacts of the costs and savings estimated with ENERGY 2020. The WCI Partner jurisdictions are planning to continue the analysis so that macroeconomic impacts, such as income, employment, and output, can be assessed. Once completed, the macroeconomic impacts can be compared to previous studies of cap-and-trade programs considered in the United States and Canada.

B. Green Technology

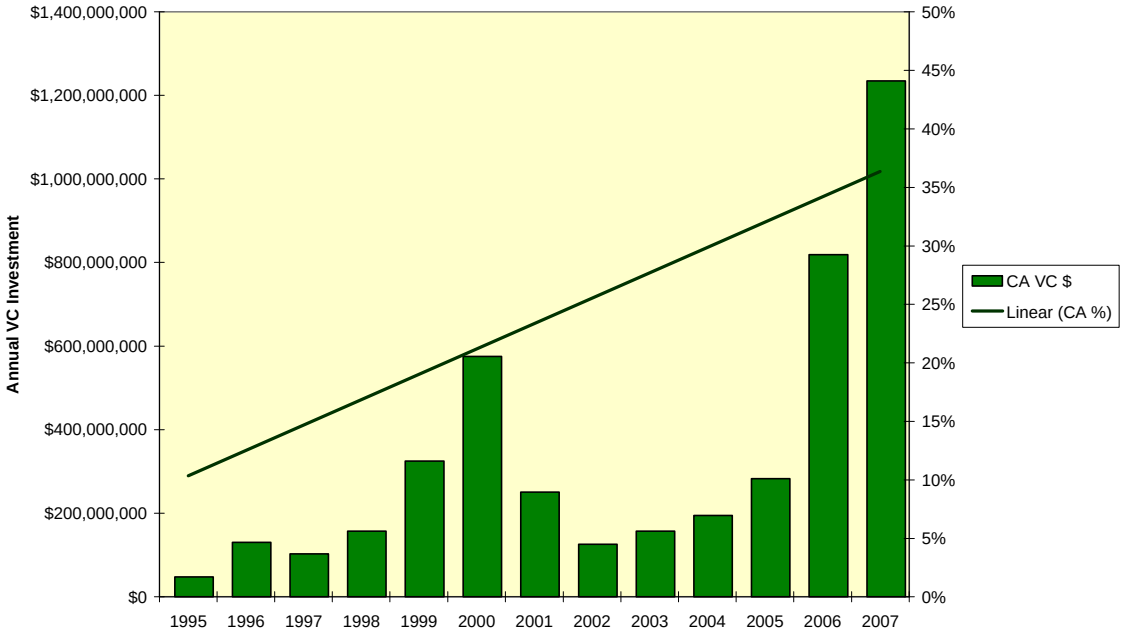
The development of green technologies and a trained workforce equipped to design, develop and deploy them will be key to the success of California's long-term efforts to combat global warming. Bold, long-range environmental policies help drive innovation and investment in emission-reducing products and services in part by attracting private capital. Typically, the private sector under invests in research and development for products that yield public benefits. However, when environmental policy is properly designed and sufficiently robust to support a market for such products, private capital is attracted to green technology development as it is to any strategic growth opportunity.

California's leadership in environmental and energy efficiency policy has helped attract an increasing share of venture capital investment in green technologies. According to statistics from PricewaterhouseCoopers and the National Venture Capital Association, California's share of U.S. venture capital investment in innovative energy technologies increased

dramatically from 1995 to 2007 (see Figure 5 below).[52] The same period saw a stream of pioneering environmental policy initiatives, including energy efficiency codes for buildings and appliances, a renewables portfolio standard for electricity generation, climate change emissions standards for light-duty automobiles and, most recently, AB 32. Flows of venture capital into California are escalating as a direct result of the focus on reductions of greenhouse gas emissions. As mentioned above, California captured the largest single portion of global venture capital investment ($800 million out a total of two billion dollars) during the second quarter of 2008.

Figure 5

California's Growing Share of Venture Capital Investment in Energy Innovation, 1995-2007 (current $, % share)



Source: PricewaterhouseCoopers MoneyTree Report, available at: [https://www.pwcmoneytree.com].

A survey of clean technology investors by Global Insight and the National Venture Capital Association found that public policy influences where venture capitalists invest.[53] Furthermore, investments in green technology solutions produce jobs at a higher rate than investments in comparable conventional technologies.[54] Venture capitalists estimate that

[52] Based on historical trend data for the 'Industrial/Energy' industry for California and the United States from the PricewaterhouseCoopers MoneyTree Report. https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=historical (accessed October 12, 2008)

[53] Clean Tech Entrepreneurs & Cleantech Venture Network LLC. *Creating Cleantech Clusters: 2006 Update*. May 2006. p.43 http://www.e2.org/ext/doc/2006%20National%20Cleantech%20FORMATTED%20FINAL.pdf (accessed October 12, 2008)

[54] Report of the Renewable and Appropriate Energy Laboratory. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at

each $100 million in venture capital funding, over a period of two decades, helps create 2,700 jobs, $500 million in annual revenues, and many indirect jobs.[55]

Access to capital controlled by institutional investors is also enhanced by policies that encourage early adoption of green technologies. When California-based corporations use green technologies to reduce their exposure to climate change risk, institutional investors reward them by facilitating their access to capital. The Investor Network on Climate Risk – including institutional investors with more than $8 trillion of assets under management – endorsed an action plan in 2008 that calls for requiring asset managers to consider climate risks and opportunities when investing; investing in companies developing and deploying clean technologies; and expanding climate risk scrutiny by investors and analysts.[56]

Additional capital for green technologies helps drive increased employment, both indirectly, as energy savings are plowed back into other sectors of the economy, and directly, as new green products are successfully commercialized.

McKinsey & Company projects average annual returns of 17 percent on global investments in energy productivity, and estimates the global investment opportunity at $170 billion annually through 2020.[57] Meanwhile, global investment in energy efficiency and renewable energy has grown from $33 billion to more than $148 billion in the last four years. Beyond 2020, green technologies are expected to attract investment of more than $600 billion annually.[58] In short, green technology is now a *bona fide* global growth industry.

Today, green technology businesses directly employ at least 43,000 Californians, primarily in energy efficiency and energy generation, according to a 2008 study from the California Economic Strategy Panel. Green jobs are concentrated in manufacturing (41 percent), and professional, scientific and technical services (28 percent), with median annual earnings of

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University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[55] Report prepared for the National Venture Capital Association. *Venture Impact 2004: Venture Capital Benefits to the U.S. Economy*. Prepared by: Global Insight. June 2004. http://www.globalinsight.com/publicDownload/genericContent/07-20-04_fullstudy.pdf (accessed October 12, 2008)

[56] The Investor Network on Climate Risk. *Final Report, 2008 Investor Summit on Climate Risk*. February 14, 2008. http://www.ceres.org//Document.Doc?id=331 (accessed October 12, 2008)

[57] McKinsey Global Institute. *The Case for Investing in Energy Productivity*. McKinsey & Company. February, 2008. p.8 http://www.mckinsey.com/mgi/reports/pdfs/Investing_Energy_Productivity/Investing_Energy_Productivity.pdf (accessed October 12, 2008)

[58] United Nations Environment Programme-New Energy Finance Ltd. *Global Trends in Sustainable Energy Investment 2008: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency* 2008. p.12 ISBN: 978-92-807-2939-9 http://www.unep.fr/energy/act/fin/sefi/Global_Trends_____2008.pdf (accessed October 12, 2008)

$35,725 and $56,754, respectively.[59] By 2030, under a moderate growth scenario, green businesses nationwide are expected to generate revenues of $2.4 trillion, (2006 dollars), and employ 21 million Americans.[60]

As a leader in green technology development and use, California has already realized substantial economic benefits from the adoption of energy efficiency policies. State energy efficiency measures have saved enough energy over the past 30 years to avoid construction of two dozen 500-megawatt power plants. Today, California's per capita electricity consumption is 40 percent below the national average, and the carbon intensity of California's economy is among the lowest in the nation.[61]

Renewable energy, such as solar, wind, biomass, geothermal, will also bring new employment opportunities to Californians while spurring economic growth. California enjoys significant comparative advantages for renewable energy: concentrated innovation resources, a large potential customer base, key natural resources such as reliable solar and wind, and supportive regulatory programs, including the California Renewables Portfolio Standard, the Million Solar Roofs Initiative, the California Global Warming Solutions Act of 2006, and the Solar Water Heating and Efficiency Act of 2007.

Other researchers have estimated that under a national scenario with 15 percent renewables penetration by 2020, California will experience a net gain in direct employment of 140,000 jobs.[62] Because investments in green technologies produce jobs at a higher rate than investments in conventional technologies, jobs losses that occur in traditional fossil fuel industries will be more than compensated for by gains in the clean energy sector.

Furthermore, if California's renewable energy suppliers field products that are sufficiently competitive to penetrate the export market, employment and earnings dividends for the state will also increase. California renewable energy industries servicing the export market can generate up to 16 times more employment than those that only manufacture for domestic

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[59] California Economic Strategy Panel with Collaborative Economics. *Clean Technology and the Green Economy*. March 2008. P.14-15 http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf (accessed October 12, 2008)

[60] The American Solar Energy Society. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. 2007. p.39 ISBN 978-0-89553-307-3 http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf (accessed October 12, 2008)

[61] California Energy Commission. *2007 Integrated Energy Policy Report*. Document No. CEC-100-2007-008-CMF. 2007. p. 3 http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF (accessed October 12, 2008)

[62] Tellus Institute and MRG Associates. *Clean Energy: Jobs for America's Future*. As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

consumption, according to a study by the Research and Policy Center of Environment California.[63]

C. Cost-Effectiveness

As noted in several provisions of AB 32, cost-effectiveness is an important requirement to be considered in the design and implementation of emission reduction strategies. (See HSC §§38505, 38560, 38561, 38562.) AB 32 defines "cost-effective" or "cost-effectiveness" as "the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential." (HSC §38505(d)) This definition specifies the metric (i.e., dollars per ton) by which the Board must express cost-effectiveness, but it does not provide criteria to assess if a regulation is or is not cost-effective. It also does not specify whether there should be a specific upper-bound dollar per ton cost that can be considered cost-effective, or how such a bound would be determined or adjusted over time. ARB has investigated different approaches that could be used to evaluate the cost-effectiveness of regulations and is recommending the following approach.

The estimated cost per ton of greenhouse gas emissions reduced by the measures recommended in this Plan ranges from $-408 (net savings) to $133, with all but one (the Renewables Portfolio Standard) costing less than $55 per ton. The RPS is being implemented for energy diversity purposes, not just greenhouse gas reductions, and the $133 per ton figure does not take these other benefits into account. Therefore, it should not be used as a reference to define the range of cost-effective greenhouse gas measures. These estimates are based on the best information available as ARB prepared this Plan. Updated estimates and greater certainty will be provided as the measures are further developed during the rulemaking process.

In the meantime, the current estimates provide a range illustrating the cost per ton of the mix of measures that collectively meet the 2020 target. This range will assist the Board in evaluating the cost-effectiveness of individual measures when considering adoption of regulations. The range of acceptable cost-effectiveness may change if effective lower-cost measures and options are identified. Because both the projections of "business-as-usual" 2020 emissions and the degree of reductions from any given measures may be greater or less than current estimates, the determination should remain flexible to accommodate a higher or lower estimate of cost-effectiveness. In addition, the approach must provide flexibility to pursue measures that simultaneously achieve policy objectives other than greenhouse gas emissions reduction (such as energy diversity).

The criteria for judging cost-effectiveness will be updated as additional technological data and strategies become available. As ARB moves from adoption of the Scoping Plan to

[63] Environment California Research and Policy Center. *Renewable Energy and Jobs. Employment Impacts of Developing Markets for Renewables in California*. July 2003. As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

developing specific regulations, and as regulations continue to be adopted, updated cost-effectiveness estimates will be established in a rigorous and transparent process with full stakeholder participation. As ARB progresses from proposed measures and estimated costs to actual regulations, the comparison of cost-effectiveness would move toward the well established practice of comparing the cost-effectiveness of new regulations to the cost-effectiveness of previously enacted and/or similar regulations. This approach is consistent with how cost-effectiveness is evaluated for strategies to reduce criteria and toxic pollutants.

D. Small Business Impact

Small businesses play an important role in California's economy. As required under AB 32, ARB analyzed the impact that implementation of the Scoping Plan would have on small businesses in the state. The analysis indicates that the primary impacts on small businesses as a result of AB 32 will come in the form of changes in the costs of goods and services that they procure, and in particular, changes in energy expenditures. Due to the number of measures in the plan that will deliver significantly greater energy efficiencies, our analysis projects that implementation of the plan will have a positive impact on small business in California even after taking into account the higher per-unit energy prices that are likely to occur between now and 2020. Small businesses also will benefit as a result of the robust economic growth and the increases in jobs, production, and personal income that are projected between now and 2020 as AB 32 is implemented. Additional information is provided in Appendix G.

Recent analysis from Energy and Environmental Economics, Inc. (E3) forecasts that a package of greenhouse gas emissions reduction measures similar to those recommended in this Plan would deliver a five percent decrease in electricity expenditures for the average California electricity customer relative to business-as-usual in 2020.[64] This projection is based on the assumption that increases in electricity prices will be more than offset by the continued expansion of energy efficiency measures and that more efficient technologies will be developed and implemented.[65] For purpose of this analysis, expenditures on natural gas are assumed to remain the same, balancing the projected 29 percent decrease in natural gas consumption in California with the model's projected natural gas price increase of almost 9 percent.

Based on this assessment, implementation of the Scoping Plan will likely have minor but positive impacts on small businesses in the state. These benefits are attributable primarily to the measures in the plan that will deliver significantly greater energy and fuel efficiencies. Even when higher per unit energy prices are taken into account, these efficiencies will decrease overall energy expenditures for small businesses. Additionally, as previously described, the California economy is projected to experience robust economic growth

[64] Based on their GHG Calculator, CPUC/CEC GHG Docket (CPUC Rulemaking.06.04.009, CEC Docket 07-OIIP-01), available at http://www.ethree.com/cpuc_ghg_model.html.

[65] The E3 analysis focuses on direct programmatic measures and does not include the incremental price impact of the cap-and-trade program, which will depend upon allowance price, allocation strategy, the capped sector industry response, and other program design decisions.

between now and 2020 as AB 32 is implemented. Small businesses will experience many of the benefits associated with this growth in the form of more jobs, greater production activity, and rising personal income.

The projected decrease in electricity expenditures is especially important for small businesses since they typically spend more on energy as a percentage of revenue compared to larger enterprises. For example, firms with a single employee spend approximately 3.3 percent of each sales dollar on electricity, while businesses with between ten and forty-nine employees spend around 1.2 percent. As a result, smaller businesses are likely to experience a greater relative benefit from decreased energy expenditures relative to their larger counterparts.

From the broader economic perspective, these changes will make California more competitive as a location for small business, moving it from 7th highest to 19th among all states in terms of the percentage of revenue that businesses expend on electricity.[66] As was noted above for low income households, care must be taken to ensure that the program is structured to allow small businesses to participate in and benefit from the energy efficiency measures.

While ARB's analysis indicates a positive impact on small businesses from AB 32 implementation, to ensure that these benefits are realized to the fullest potential it will take additional outreach and communication efforts on the part of ARB and many other state and local entities. There are a number of existing programs that are designed to help small businesses achieve greater efficiencies in energy use. These programs can be enhanced and expanded upon, and new programs and efforts can be developed to ensure that all small businesses in California are aware of and able to take cost-effective steps to reduce energy use and enjoy the associated economic savings. For example, as discussed more completely in Chapter IV, ARB and our partners in State government are working together to develop an on-line small business "toolkit" designed for small and medium-sized businesses to provide a one-stop shop of technical and financial information resources. As further development and implementation of the measures in the plan proceeds, we will work with other state and local partners to ensure that small businesses can both benefit from and play a role in helping to achieve our greenhouse gas emission reduction requirements.

E. Public Health/Environmental Benefits Analyses

AB 32 requires ARB to evaluate the environmental and public health impacts of the Scoping Plan. The analysis of this plan is focused primarily on the quantification of public health benefits from air quality improvements that would result from implementation. Unlike traditional pollutants and toxic emissions, global warming pollutants do not typically have localized impacts. At ambient levels, carbon dioxide, which makes up over 80 percent of global warming pollutants in California, has no direct environmental or public health consequences. Climate change caused by greenhouse gas pollutants emitted in another state

[66] Although the natural gas data is less specific, a similar scenario is expected where increased prices are typically offset by greater efficiencies for most small businesses.

or country has the same potential to damage our public health and the environment as does climate change due to pollutants emitted within California. Although this analysis does not consider the public health impacts of climate change, the potential public health impacts are great, and have been well documented elsewhere. However, many of the measures aimed at reducing global warming pollutants also provide co-benefits to public health and California's natural resources.

The environmental and cumulative impacts of the Plan are discussed in the California Environmental Quality Act (CEQA) document that is included in Appendix J. As the Scoping Plan is implemented, and specific measures are developed, ARB will conduct further CEQA analyses, including cumulative and multi-media impacts. As ARB further develops its approach for consideration of these issues in future rulemakings, and updates needed analytical tools and data sets, we will consult with outside experts and the EJAC. ARB recognizes that the adoption of the Scoping Plan will launch a variety of regulatory proceedings in many different venues. ARB will work closely with other California State agencies including: the Office of Planning and Research, Environmental Protection Agency, Resources Agency, Integrated Waste Management Board, Department of Public Health, Office of Environmental Health Hazard Assessment, State Water Resources Control Board, Department of Toxic Substances Control, Department of Water Resources, Board of Forestry, Department of Fish and Game, Public Utilities Commission, California Energy Commission, and others to identify and address potential multi-media environmental impacts early in the regulatory development process.

California's actions to reduce greenhouse gas emissions will help transition the State to new technologies, improved efficiencies, and land use patterns also necessary to meet air quality standards and other public health goals. California's challenging public health issues associated with air pollution are already the focus of comprehensive regulatory and incentive programs. These programs are reducing smog forming pollutants and toxic diesel particulate matter at a rapid pace. However, to meet increasingly stringent air quality standards and air toxics reduction goals, transformative changes are needed in the 2020 timeframe and beyond. Implementation of AB 32 will provide additional support to existing State efforts devoted to protecting and improving public health.

1. Key Air Quality-Related Public Health Benefits

The primary direct public health benefits of the Scoping Plan are reductions in smog forming emissions and toxic diesel particulate matter. The most significant reductions are of oxides of nitrogen (NOx), which forms both ozone and particulate pollution (PM2.5), and directly emitted PM2.5, which includes diesel particulate matter. The analysis focuses on PM2.5 impacts and quantifies 2020 public health benefits of this plan in terms of avoided premature deaths, hospitalizations, respiratory effects, and lost work days. Additional benefits associated with the reductions in ozone forming emissions were not quantified since statewide 2020 photochemical modeling is not available.

The estimated air quality-related public health benefits of the Scoping Plan are above and beyond the much greater benefits of California's existing programs, which are reducing air pollutant emissions every year. This continuing progress is the result of California's plans for meeting air quality standards ("State Implementation Plans" or SIPs), reducing emissions from goods movement activities, and addressing health risk from diesel particulate matter. These programs address both existing and new sources of air pollution, taking into account population and economic growth. The additional benefits of the Scoping Plan in 2020 are significant, and in the longer term, can be expected to increase with further reductions in fossil fuel combustion, the primary basis for the estimated public health benefits.

The recommended measures in the Scoping Plan that reduce smog forming ("criteria") pollutants are shown in Table 29 along with the estimated reductions. Statewide, these measures would reduce approximately 61 tons per day of NOx and 15 tons per day of PM2.5 in 2020. As shown in Table 30, this equates to an estimated air quality-related public health benefit of 780 avoided premature deaths statewide. In comparison, reductions in PM2.5 from California's existing programs and 2007 SIP measures are estimated to result in 12,000 avoided premature deaths statewide in the same timeframe.

Table 29: Statewide Criteria Pollutant Emission Reductions in 2020 from Proposed Scoping Plan Recommendation[67]

(tons per day)

Measure	NOx	PM2.5
Light-Duty Vehicle • Pavley I and Pavley II GHG Standards • Vehicle Efficiency Measures	1.6	1.4
Goods Movement Efficiency Measures	16.9	0.6
Medium and Heavy-Duty Vehicle GHG Emission Reduction • Aerodynamic Efficiency • Hybridization • Engine Efficiency	5.6	0.2
Local Government Actions and Regional Targets	8.7	1.4
Energy Efficiency and Conservation (Electricity)	7.0	4.0
Energy Efficiency and Conservation (Natural Gas)	10.4	0.8
Solar Water Heating	0.3	0.03
Million Solar Roofs	1.0	0.6
Renewables Portfolio Standard	9.8	5.6
Total	**61**	**15**

[67] Table 29 does not include the criteria pollutant co-benefits of additional greenhouse gas reductions that would be achieved from the proposed cap-and-trade regulation because we cannot predict in which sectors they would be achieved.

Table 30: Estimates of Statewide Air Quality-Related Health Benefits in 2020

Health Endpoint	Health Benefits of Existing Measures and 2007 SIP *mean*	Health Benefits of Recommendations in the Proposed Scoping Plan *mean*
Avoided Premature Death	12,000	780
Avoided Hospital Admissions for Respiratory Causes	1,300	87
Avoided Hospital Admissions for Cardiovascular Causes	2,600	170
Avoided Asthma and Lower Respiratory Symptoms	190,000	12,000
Avoided Acute Bronchitis	15,000	980
Avoided Work Loss Days	1,200,000	77,000
Avoided Minor Restricted Activity Days	7,000,000	450,000

In addition to the quantified air-quality-related health benefits, our analysis indicates that implementation of the Scoping Plan can deliver other public health benefits as well. These include potential health benefits associated with local and regional transportation-related greenhouse gas targets that can facilitate greater use of alternative modes of transportation, such as walking and bicycling. These types of moderate physical activities reduce many serious health risks including coronary heart disease, diabetes, hypertension and obesity.[68] Finally, it is important to note that the steps California is taking to address global warming, along with actions by other regions, states, and nations, will help mitigate the public health effects of heat waves, more widespread incidence of illness and disease, and other potentially severe impacts.

The measures in the Scoping Plan are designed primarily to help spur the transition to a lower carbon economy. However, in addition to improving air quality, these measures can also improve California's environmental resources, including land, water, and native species. Land resources will be affected by regional transportation-related targets leading to improved land use planning, and forest carbon sequestration targets which can result in better stewardship of California lands and reduced wildfire risk. A number of conservation measures will aid in effective management of the State's precious water resources. Demand for waste disposal and hazardous materials should decrease as measures to encourage recycling and reuse transform our wastes into fuel, energy, and other useful products are implemented. Additional analysis of the way that implementation of the Scoping Plan will impact these environmental resources will be conducted as we proceed. Many of these measures serve the dual purpose of mitigating greenhouse gas emissions and helping California adapt to the impacts of climate change.

[68] Appendix H contains a reference list of studies documenting the public health benefits of alternative transportation.

2. Approach

ARB quantified the potential reductions of NOx and PM2.5 from implementation of the Plan's recommendations, and the public health benefits associated with the resulting potential air quality improvement. These analyses compare NOx and PM2.5 emissions in 2020 with the implementation of the Scoping Plan with NOx and PM2.5 emissions in 2020 in the absence of the Scoping Plan – a "business-as-usual" scenario. The methodology used to evaluate the public health benefits of the emission reductions is similar to the methodology used in ARB's 2006 Goods Movement Emission Reduction Plan (GMERP), as updated in the recent staff report for estimating premature death from exposure to particulate matter.[69] This methodology is based on a peer-reviewed methodology developed by the U.S. Environmental Protection Agency (U.S. EPA). ARB augmented U.S. EPA's methodology by incorporating the result of new epidemiological studies relevant to California's population, including regionally specific studies, as they became available.

AB 32 directs ARB to conduct several levels of analysis as we proceed through the development and implementation of a comprehensive greenhouse gas emissions reduction strategy. As part of the Scoping Plan development, ARB is required to assess both the economic and non-economic impacts of the plan as noted above. Additionally, AB 32 requires ARB to undertake additional analysis at the time of adoption of regulations, including market-based compliance mechanisms.

Although not yet at the stage of regulatory development and adoption, in this analysis ARB conducted an evaluation of the air quality-related public health benefits associated with the Scoping Plan based on a community level emissions analysis example. As regulations that rely on market-based compliance mechanisms are further developed for consideration by the Board, more detail about the specific regulatory proposals will be developed, enabling ARB to more closely evaluate the potential for direct, indirect and cumulative impacts.

3. Existing Programs for Air Quality Improvement in California

The public health analysis of the Scoping Plan presents air-quality benefits that will occur in addition to the benefits of California's comprehensive air quality programs designed to meet health-based standards and reduce health risk from air toxics. It is also important to note that under both a "business-as-usual" scenario and under the implementation of the Scoping Plan, the population and economy of California are projected to continue to grow. New businesses and industries will continue to be sited in California, bringing both economic opportunity and potential environmental impacts. Federal, State, and local laws and regulations have established requirements to ensure that new and modified sources of pollution are carefully evaluated and that

[69] Air Resources Board. *Methodology for Estimating Premature Deaths Associated with Long-term Exposure to Fine Airborne Particulate Matter in California.* October 24, 2008. http://www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf (accessed December 9, 2008)

significant impacts are mitigated. Emissions from existing businesses are also tightly controlled by local air pollution control districts. Statewide programs are in place to reduce emissions from cars, trucks, and off-road equipment, along with smog check, cleaner gasoline and diesel fuels, and regulations to reduce evaporative emissions from consumer products, paints, and refueling. Additional information about the existing regulatory framework for sources of air pollution is provided in Appendix H.

It is important to evaluate the air quality and public health benefits of the Scoping Plan in the context of the State's on-going air quality improvement efforts. California's long-standing air pollution control programs have substantially improved air quality in the state and will continue to do so in the future. By 2020, these programs will deliver reductions in statewide NOx emissions of 441 tons per day and direct fine particle emission reductions of 34 tons per day. Through 2020, three key ARB efforts will deliver deep reductions in air pollutant emissions despite continuing growth:

- Diesel Risk Reduction Plan
- Goods Movement Emission Reduction Plan
- 2007 State Implementation Plan

Measures in these plans will result in the accelerated phase-in of cleaner technology for virtually all of California's diesel engine fleets including trucks, buses, construction equipment, and cargo handling equipment at ports. Adoption and implementation of these and other measures are critical to achieving clean air and public health goals statewide.

The U.S. Environmental Protection Agency has set a new, more stringent, national ambient air quality standard for ozone that will have compliance deadlines well past 2020 for the most severely impacted areas like southern California.[70] The unmitigated impacts of climate change will make it harder to meet this standard and to provide healthful air to Californians.

4. Statewide Analysis

For this evaluation, ARB examined the recommended measures to determine the potential for impacts on air, land, water, native species and biological resources, and waste and hazardous materials. Local government, State government, and green building sectors were not included in this evaluation as they represent means of implementation of the greenhouse gas emission reduction measures. As noted, the main focus of this analysis is on air quality. To the extent feasible, ARB quantified estimated emissions reductions in criteria pollutants associated with each recommended measure except cap-and-trade. Reductions in NOx and PM2.5 were

[70] U.S. Environmental Protection Agency. *National Ambient Air Quality Standards for Ozone. Final Rule.* 73 Federal Register 16436. March 27, 2008. http://www.epa.gov/fedrgstr/EPA-AIR/2008/March/Day-27/a5645.pdf (accessed October 12, 2008)

used to estimate public health benefits. The estimated statewide reductions are 61 tons per day of NOx and 15 tons per day of PM2.5. Further analysis of the potential criteria pollutant benefits of a cap-and-trade program will be done as part of regulatory development.

5. Regional Assessment: South Coast Air Basin Example

In order to assess potential air quality benefits of the Scoping Plan on a regional level, ARB evaluated associated criteria pollutant reductions in the South Coast Air Basin as an example case. Existing programs will reduce current NOx emissions by almost 50 percent in 2020. With the new 2007 SIP measures, NOx emissions will be reduced almost 60 percent. Because of the large population and high pollutant concentrations in this region, greater benefits occur from each ton of pollution reduced. The estimated air quality-related public health benefits of the Scoping Plan for the South Coast region are shown in Table 31. The significant air quality-related public health benefits in this region are largely attributed to the additional reductions in PM2.5.

Table 31: Estimated Air Quality-Related Health Benefits of Existing Program, 2007 SIP, and Scoping Plan in the South Coast Air Basin, 2020

Health Impacts / Scenario	Benefits from Existing Program	Additional Benefits from 2007 SIP	Additional Co-Benefits from Scoping Plan
Premature Deaths Avoided	4,800	2,000	360
Hospitalizations Avoided – Respiratory	550	230	40
Hospitalizations Avoided – Cardiovascular	1,100	440	77
Asthma & Lower Respiratory Symptoms Avoided	80,000	35,000	6,200
Acute Bronchitis Avoided	6,400	2,800	500
Work Loss Days Avoided	510,000	220,000	38,000
Minor Restricted Activity Days Avoided	3,000,000	1,300,000	220,000

6. Community Level Assessment: Wilmington Example

ARB also conducted an evaluation of the potential air quality impacts of the Scoping Plan in the community of Wilmington as an illustration of the potential for localized impacts. Wilmington is in southern Los Angeles County and includes a diverse range of stationary and mobile emissions sources, including the ports of Los Angeles and Long Beach, railyards, major transportation corridors, refineries, power plants, and other industrial and commercial operations. Like the regional analysis, additional emission reductions from the 2007 SIP were estimated and show significant reductions in Wilmington by 2020 – approximately a 45 percent reduction in NOx and a 40 percent reduction in directly-emitted PM2.5. Mobile source emissions are projected to continue to be proportionately greater than stationary source emissions in 2020 even as mobile source emissions decline.

For this assessment, ARB evaluated criteria pollutant emission reductions in the Wilmington study area assuming that the source-specific quantified measures are implemented, including measures to reduce emissions from oil and gas extraction and refineries. It was further assumed that the non-source specific program elements, such as the proposed cap-and-trade program, result in a 10 percent reduction in fuel combustion by affected sources within the study area. For example, it is estimated that industrial sources would achieve greenhouse gas emission reductions through efficiency measures that reduce on site fuel use by 10 percent either in response to a cap-and-trade program, or due to the results of the facility energy efficiency audits. While it is likely that the actual onsite reductions will differ across individual facilities from the assumed uniform ten percent reduction,[71] the analysis identifies how reductions at these facilities affect the overall level of co-benefits.

The estimated NOx co-benefit of about 1.7 tons per day is small relative to the projected reductions of 24 tons per day that will occur as a result of the SIP and other measures. For example, an 8 ton per day NOx reduction is expected from cleaner port trucks. In comparison, the potential NOx benefit from a 10 percent efficiency improvement in major goods movement categories is estimated at about 1.5 tons per day. The estimated PM2.5 co-benefits, on the order of 0.12 tons per day, are also small relative to the projected reductions of 2.3 tons per day that will occur as a result of the SIP and other measures. Approximately 30 percent (0.04 ton per day) of the PM 2.5 co-benefit reduction is associated with assumed energy efficiency measures at the four large refineries in the study area, while another 30 percent would occur due to a 10 percent efficiency improvement by goods movement sources.

The co-benefit emissions reductions in the study area would produce regional air quality-related health benefits. A relatively small portion of these benefits would occur in the study area (approximately 300,000 area residents). Health benefits due to reductions in NOx are mostly at the regional levels, since NOx emissions have usually travelled some distance before they are transformed into PM via atmospheric reactions. Point source combustion PM emissions persist in the atmosphere and increase exposures both in the area where they are emitted and broadly throughout the region. Based on previous modeling studies of the impact of port and rail yard PM emissions in the South Coast Air Basin conducted by ARB, PM exposures will be reduced far beyond the study area, and a majority of the health benefits are expected to occur in areas outside of the Wilmington community.[72]

Using the previously described methodology that correlates emission reductions in the air basin with expected regional health benefits there would be an estimated

[71] The reductions at any one facility could be much greater or lesser than 10 percent For example, very small or no reductions might occur because available cost-effective industrial emission reductions have already been implemented at a particular site.

[72] ARB analysis indicates that about 20 percent of the health benefits would occur in the Wilmington area.

24 avoided premature deaths attributed to emission reductions that occur in Wilmington as a result of the Scoping Plan.[73]

F. Summary of Societal Benefits

AB 32 requires ARB to "consider the overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health" (HSC § 38562(b)(6)) when developing regulations to implement the Scoping Plan. ARB conducted an initial assessment of societal benefits associated with AB 32 implementation. This section summarizes those that have been identified during development of the Scoping Plan, including diversification of energy sources, mobility, regressivity, and job creation. More detailed economic and environment/public health analyses can be found in Appendix G and H, respectively. The impact of low income households (regressivity), impacts on small businesses, and impact on jobs are described in the Economic Analysis section and Appendix G.

1. Energy Diversification

Generally, energy-related measures in this Scoping Plan are expected to result in a transformation of the State's energy portfolio, driven primarily by the Low Carbon Fuel Standard (LCFS), which addresses transportation fuel, and the 33 percent RPS, which increases renewably-produced electricity production and distribution to households and businesses.

The LCFS aims to achieve at least a 10 percent reduction in the carbon intensity of California's transportation fuels by 2020. As the State moves toward less dependence upon one source of fuel for transportation, our economy will be less at risk from significant fluctuations in fuel prices. Measures within the Scoping Plan will force energy diversification in California toward low-carbon intensive energy sources and encourage significant growth in infrastructure, capital, and investment in biofuels.

The move toward 33 percent renewables will, by definition, increase the diversification of California's electrical supply. Increased use of wind, solar, geothermal and biomass (including from the organic fraction of municipal solid waste) generation will all add to ensuring the state has a broader portfolio of energy inputs.

Based on ARB's economic analysis, the combined energy diversification and increased energy efficiency expected from implementation of the Scoping Plan is predicted to result in: a 25 percent decrease in gasoline usage (4.6 billion gallons), a 17 percent decrease in diesel fuel use (670 million gallons), a 22 percent decrease in electricity (74,000 GWh reduction) and a 24 percent reduction in natural gas (3,400 therms).

[73] See Appendix H

The cap-and-trade program, offsets, and other measures that contain market-based features may also help diversify California's energy portfolio by incentivizing the development and deployment of clean and efficient energy generating technologies.

2. Mobility and Shifts in Land Use Patterns

Mobility is analyzed through multiple approaches in the Scoping Plan. Appendix C includes an analysis of a proposed measure for regional transportation-related greenhouse targets. Reductions in vehicle miles traveled (VMT) are expected to result from regional and local planning which target land use, building and zoning improvements.

As the Scoping Plan is implemented, measures that support shifts in land use patterns are expected to emphasize compact, low impact growth in urban areas over development in greenfields. Communities could realize benefits, such as improved access to transit, improved jobs-housing balance, preservation of open spaces and agricultural fields, and improved water quality due to decreased runoff. Local and regional strategies promoting appropriate land use patterns could encourage fewer miles traveled, lowering emissions of greenhouse gases, criteria pollutants and PM. More compact communities with improved transit service could increase mobility, allowing residents to easily access work, shopping, childcare, health care and recreational opportunities.

Furthermore, if open spaces and desirable locations become more accessible and communities are designed to encourage walkability between neighborhoods and shopping, entertainment, schools and other destinations, residents are likely to increase their levels of physical activity. Research shows that regular physical activity can reduce health risks, including coronary heart disease, diabetes, hypertension, anxiety and depression, and obesity. Measures in the Scoping Plan encourage Californians to use alternatives to personal vehicle travel that could result in increased personal exercise. To complement these changes, future community developments may evolve to include trails and pedestrian access to major centers. However, where compact development may increase proximity to large sources of pollution, such as high traffic arterials, distribution centers, and industrial facilities, it will be critical to analyze the anticipated and unanticipated impacts and benefits, to ensure that increases in exposure to vehicular air pollution and other toxics and particulates do not occur .

G. California Environmental Quality Act Functional Equivalent Document

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed projects. ARB's analysis of the potential adverse environmental impacts of the Scoping Plan is presented in Appendix J. The analysis summarizes and discusses the specific strategies in the Scoping Plan that, if adopted and implemented, will reduce greenhouse gas emissions throughout the state. The

evaluation is programmatic by necessity; it allows consideration of broad policy alternatives and program-wide mitigation measures at a time when an agency has greater flexibility to deal with basic problems of cumulative impacts. A programmatic document also plays an important role in establishing a structure within which future reviews of related actions can be effectively conducted. The Secretary of California's Resources Agency determined that ARB meets the criteria for a Certified Regulatory Program and requires ARB to prepare a substitute document. This functionally equivalent document (FED) is intended to disclose potential adverse impacts and identify mitigation measures specific to the actions identified in the Scoping Plan. The analysis generally found that the proposed Low Carbon Fuel Standard, Renewables Portfolio Standard and Water measures have the most potential to cause adverse environmental impacts due to the potential for land conversion when projects are undertaken. Additional environmental analysis will be needed when regulations are adopted and at the individual project level to identify mitigation for project specific impacts.

H. Administrative Burden

ARB conducted a assessment of the administrative burden of implementing the Scoping Plan recommendation. (HSC §38562 (b)(7)) The recommendation calls for ARB to develop a cap-and-trade program – a market-based regulatory program to cap and reduce emissions from the Industrial, Electricity, Natural Gas, and Transportation sectors. This program would require stringent monitoring and reporting on the part of the regulated community, and comprehensive enforcement on the part of ARB. Sources under the cap would need to analyze the best approach for their company to comply with a cap – assessing the cost of reducing emissions and comparing that to the cost of purchasing emission reductions in a market. Although ARB has not previously developed this type of market regulation, there is extensive experience to draw upon from within California, nationally, and internationally. In addition, the other regulatory components of the recommendation would require ARB and other State agencies to adopt a series of measures requiring regulatory development, outreach to stakeholders and the public, implementation by industry, and enforcement for numerous measures and programs.

I. De Minimis Emission Threshold

A minimum level at which regulations are determined not to apply is termed the 'de minimis threshold.' In recommending a de minimis level, ARB must take into account the relative contribution of each source or source category to statewide greenhouse gas emissions and the adverse effect on small business. (HSC §38561(e)) This threshold acts as a buffer below which the burden of regulation is determined to outweigh the potential harmful effect of the minimal level of emissions. However, it should not be assumed that an individual source of greenhouse gas emissions that is minimal if taken by itself will fall below the threshold. ARB often looks at the aggregate emissions from a source category or related source category when determining regulatory applicability.

A source category may be evaluated as the aggregate of businesses doing the same type of work (e.g., semiconductor manufacturers), a type of equipment (cargo handling equipment, cars), a process or product (cans of pressurized duster), or other aggregated sources of

emissions. Emissions of greenhouse gases from any individual entity within these source categories by themselves could be small. However, when emissions from the source category are evaluated, the relative contribution to climate change can be significant.

As ARB developed the Scoping Plan, potential measures were evaluated against criteria that included the relative contribution of the source to climate change. After this review and considering the level of emissions needed to meet the 1990 target established by AB 32, ARB recommends a de minimis level 0.1 $MMTCO_2E$ annual emissions per source category.[74] Source categories whose total aggregated emissions are below this level are not proposed for emission reduction requirements in the Scoping Plan but may contribute toward the target via other means.

ARB and other agencies implementing measures included in the Scoping Plan should carefully consider this de minimis level in developing regulations, and only regulate smaller source categories if there is a compelling necessity.

As each regulation to implement the Scoping Plan is developed, ARB and other agencies will consider more specific de minimis levels below which the regulatory requirements would not apply. These levels will consider the cost to comply, especially for small businesses, and other factors.

[74] The Forest sector was not included in determining the de minimis level because this sector serves both as a source and a sink for carbon, making the concept of a de minimis level less applicable.

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IV. IMPLEMENTATION: Putting the Plan into Action

Adoption of this Scoping Plan will be a groundbreaking step forward for California. However it is only the beginning of a journey that will last for decades, gradually moving the State into a low-carbon, clean energy future. Putting the Scoping Plan into action will be challenging but with adequate commitment and leadership from Californians up and down the state, it will be a success.

A. Personal Action

The greenhouse gas emission reductions required under AB 32 cannot be realized without the active participation of the people of California. While many of the measures in this Plan must be taken by large sources of emissions, such as power plants and industrial facilities, it is the voluntary commitment and involvement of millions of individuals and households throughout the State that will truly make this California's Plan.

Shifts in individual choices and attitudes drive changes in the economy and in institutions. This dynamic of changing individual behavior will influence California's effort to reduce greenhouse gas emissions. For example, as market forces and environmental awareness encourage more people to drive low-greenhouse gas emitting vehicles, the auto manufacturers will respond with more innovative models and more intensive research. Regulations requiring auto manufacturers to provide these cars will complement the market demand.

This means that thinking about climate change and our carbon footprint will naturally become part of how individuals make decisions about travel, work, and recreation. Some families may choose to purchase a more efficient vehicle when it comes time to replace their current model. Households may choose to lower their thermostat to 68 degrees Fahrenheit during the colder months, and raise it to 78 degrees when air conditioning is required. Some households may choose to swap out incandescent light bulbs for more efficient compact fluorescent lights. Others may choose to install solar water heaters, or arrays of solar electric panels on their roofs to take advantage of renewable energy, and lower their household energy bills. Many households may choose to plant trees to shade and cool their homes, and use landscaping and plants that require less water.

This Plan recommends measures that will help support many of these individual decisions to improve energy efficiency. Statewide measures and regional efforts will result in programs to promote public transportation or riding in carpools, subsidize the purchase of energy efficient appliances, or provide incentives to better insulate and weatherize older homes. ARB is fully committed to assuring California consumers have the widest possible choice of vehicles that emit fewer greenhouse gases than today's models, including the most advanced technology vehicles produced anywhere in the world.

Californians have embraced statewide programs that support positive change in home and business behavior. In less than two decades, separating household waste and recycling at home and work have become commonplace, as has the widespread purchase of appliances with the Energy Star label to save energy. Reducing our carbon footprint by moving toward a cleaner more efficient economy will produce a wide range of benefits to individuals, through lower energy bills and a healthier environment for all.

Conservation can also play a key role. By employing practices to use our resources more sparingly, consumers can both save money and reduce greenhouse gas emissions. On August 18, 2008, Governor Arnold Schwarzenegger launched the EcoDriving program – a comprehensive effort to save consumers money at the gas pump, reduce fuel use and cut CO_2 emissions. By following a set of easy-to-use best practices for driving and vehicle maintenance, a typical EcoDriver can improve mileage by approximately 15 percent. Furthermore, safety is improved when driving speeds are reduced, a key EcoDriving strategy.

Similarly, consumers and businesses can save money and reduce greenhouse gas emissions by conserving resources at homes, offices and commercial buildings. For example, wireless monitor devices to provide instantaneous energy-usage information inside the home are being developed to show users how many kilowatt hours they're consuming at any given moment – as well as how much it's costing them.[75] Providing real-time information on appliance energy use can greatly assist consumers in conserving electricity use.

Many Californians concerned about climate change have also begun to buy carbon offsets to mitigate the impact of their daily activities. These can take various forms, including options that allow consumers to add 'carbon credits' when buying airline tickets, or paying a small monthly charge on utility bills to buy green power. ARB will be working to establish clear rules for voluntary reductions and offsets that might be used for compliance with AB 32. These rules will also help establish clear guidelines for these types of voluntary carbon credit programs and provide California's businesses and consumers greater assurance that money spent on these programs result in real reductions in greenhouse gas emissions.

For more information about how to reduce one's personal carbon footprint, visit www.coolcalifornia.org. This web site provides a carbon footprint calculator and a "top ten" list of ways to save energy at home.

B. Public Outreach and Education

To be successful, a climate action program needs an effective public outreach and education program. The Plan calls for a robust statewide program designed to generate awareness and involvement in California's climate change efforts.

[75] The Sacramento Municipal Utility District (SMUD) is subsidizing PowerCost Monitors to 5,000 customers as a part of a demonstration program. [www.smud.org/residential/saving-energy/monitor.html]

The Climate Action Team will convene a steering team that includes State agencies and other public agencies such as the state's air districts, and public and private utilities, which have a strong track record of successful efforts at public education to reduce driving (Spare the Air) or promote energy efficiency and reduce energy demand. With the release of the California Energy Efficiency Strategic Plan, the CPUC has committed to the launch of a new brand for California Energy Efficiency in 2009, focused on energy efficiency opportunities and coordinated with climate change messaging under AB 32. The steering committee will develop a coordinated array of messages and draw upon a wide range of messengers to deliver them. These will include regional and local governments whose individual outreach campaigns can reinforce the broader State outreach themes while also delivering more targeted messages directly tied to specific local and regional programs.

To ensure that all Californians are included in efforts to address climate change, California will also support highly localized efforts at public education and outreach at the community and neighborhood level. This includes service club organizations and existing faith-based communities – churches, mosques and synagogues. Other private-sector entities including businesses and local chambers of commerce will be invited to partner in spreading the word.

1. Involving the Public and Stakeholders in Measure Development

In keeping with the requirements of AB 32 and the legacy of four decades of regulatory development at ARB, we have worked to make this process fully transparent and will continue to do so as regulations to implement the plan are developed. We will continue our efforts to involve the public to the greatest extent feasible at every stage of the process, including informal and formal rulemaking activities. This will include disadvantaged communities and those with localized concerns, as well as affected industries and small businesses.

Local and community meetings and outreach have been and will continue to be a central element of all rulemaking, with State agencies working closely with disadvantaged communities, EJAC, public health experts, and other stakeholders to fully evaluate the impacts associated with California's greenhouse gas emissions reduction strategies. State agencies involved in measure development will continue to meet periodically with communities to assess any challenges to implementation, or to discover possible new measures or approaches. Stakeholders will be invited to participate in the many additional workshops, workgroups and seminars that will be held as individual measures are developed.

2. Education and Workforce Development

The transition to a clean energy future presents California with a tremendous opportunity to continue growing its green economy and to expand the growth of green job opportunities throughout the state. Making this transition will require a technically educated workforce that is equipped with the skills to develop and deploy 21st century technologies. Investments in training, career technical education, worker

transition assistance, and collaboration between public and private partners will be key to ensuring that California fully reaps the economic and job opportunities that will accompany implementation of AB 32.

Setting California on track to a low-carbon future beyond 2020 will be a multi-generational challenge. To meet this challenge, climate-related education in schools must be a central element of California's plan. By 2010, California will develop climate change education components to the State's new K-12 model school curriculum as part of the Education and the Environment Initiative (AB 1548, Pavley, Chapter 665, Statutes of 2003). Expanding the knowledge and opportunities of young people to participate in promoting their own and their communities' environmental health will be an important theme for all these efforts. In the meantime, ARB's educational outreach will continue through the Cool California web pages (www.coolcalifornia.org) and the continued support of student educators through the California Climate Champions programs. ARB will also rely on partners throughout the state to develop and display options for curricula that will enhance the K-12, community college, trade technical training programs, and programs at four-year colleges.

The demand for workers to fill green jobs is rising. There are currently more than 3,000 green businesses in the state, accounting for about 44,000 jobs: 36 percent of these jobs are in professional, scientific, and technical services; 19 percent are in construction; and 15 percent are in manufacturing.[76] Some of these jobs are in new fields, yet many others are simply augmentations of existing skills and vocations such as electrical, construction, machining, auto tech, and heating ventilation and air conditioning. As we move toward 2020, tens of thousands of new green job opportunities will be created.[77] Whether these opportunities come in entirely new fields of employment or in existing areas, it will be critical for California to have a trained workforce available.

Ensuring that California can continue to meet the demand for green jobs will require close coordination between workforce development agencies, businesses, State and local governments, labor unions, and community colleges and universities. Many organizations are already developing strategies and identifying steps to simultaneously meet industry workforce needs and help build a more sustainable economy. For instance, the California Labor and Workforce Development Agency (LWDA) provides a comprehensive range of employment and training services in partnership with State and local agencies and organizations. Similar additional efforts will be crucial in ensuring that the transition to a green economy benefits working

[76] California Economic Strategy Panel. *Clean Technology and the Green Economy; Growing Products, Services, Businesses and Jobs in California's Value Network*, Draft, March 2008. http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf

[77] Tellus Institute and MRG Associates. *Clean Energy: Jobs for America's Future.* As cited in: *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. p. 11 http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf

families in California by providing a steady supply of livable-wage jobs. In the area of energy efficiency, the California Long Term Energy Efficiency Strategic Plan, adopted by the CPUC, details a vision and supporting strategies for the development of a workforce trained and engaged to achieve California's energy-efficiency objectives.

The following strategies will be key to ensure that California's workforce is equipped to help lead the transition to a clean energy future:

- **Strengthen and expand access to Career and Technical Education (CTE) in California public schools for the next generation of workers who will build a green economy.** Over the past several decades, there has been a steady decline in career and technical education. In 2007, less than one-third of all high school students in the state were enrolled in some form of CTE.[78] To take full advantage of the emerging green economy and meet the goals of AB 32, California needs to expand opportunities for CTE in schools. This could include pursuing strategies such as requiring CTE coursework for all middle- and high-school students; increasing the number of CTE credentialed teachers; expanding investment in facilities and equipment for career and technical education; and aligning educational curricula more closely with the skill and workforce needs of the emerging green economy.

- **Ensure an adequate pipeline of skilled workers who are trained in the new technologies of a greener economy.** While some green jobs will be in new businesses and new occupations, most green jobs are variations of traditional occupations in sectors like construction, utilities, manufacturing and transportation.[79] In light of the fact that forty percent of the nation's skilled workers are slated to retire in the next 5 to 10 years,[80] there is an urgent need for educational and training programs to fill these jobs. Strategies to create a steady pipeline of skilled workers include expanding curriculum choices in schools, colleges, and universities to fully reflect career opportunities available in an economy increasingly centered on clean technologies. Other strategies include offering a greater array of industry- and technology-specific courses that would link directly with postsecondary training such as apprenticeship programs, vocational training, or college.

- **Ensure that California's higher education institutions continue to produce the next generation of clean tech engineers, scientists and business leaders.** In addition to providing valuable research on potential climate-change mitigation and adaptation strategies, California's world-class research institutions are the

[78] Get REAL. *Aligning California's Public Education System with the 21st Century Economy Policy Paper for Discussion at Governor Arnold Schwarzenegger's Summit on Career and Technical Education*, March 6, 2007

[79] Ibid.

[80] The New Apollo Program, Clean Energy, Good Jobs: A National Economic Strategy for the New American Century, July 2008. p. 20 http://apolloalliance.org/downloads/fullreportfinal.pdf (accessed October 12, 2008)

incubators for many of the clean tech companies that will contribute to California's environmental and economic future. It will be critical for California to continue to cultivate university research and training programs in a way that takes full advantage of this valuable state resource.

A successful transition to a clean energy future depends heavily on California's ability to provide a well-trained workforce to meet the demands of the growing green economy. ARB and our key partners will continue working throughout the state to ensure that an adequate supply of skilled workers is positioned to take advantage of the growing opportunities for high quality jobs and careers that implementation of AB 32 will bring.

3. Small Businesses

Small businesses play a crucial role in California's economy. As noted in Chapter III, our analysis indicates that this plan will have a net positive impact on small businesses. These impacts are attributable primarily to the measures in the plan that will deliver significantly greater energy and fuel efficiencies. However, as also noted in the analysis, ensuring that these benefits are realized to the fullest potential will require additional outreach and communication efforts by ARB and many other state and local entities.

One of ARB's Early Action measures is designed to help businesses during AB 32 implementation. With our State partners, we are developing an on-line small business "toolkit" designed for small and medium-sized businesses that will provide a one-stop shop for technical and financial resources. Toolkit components will include a business-specific calculator to assess a company's carbon footprint; a voluntary greenhouse gas inventory protocol for measuring greenhouse gas emissions; recommended best practices for energy, transportation, building, purchasing, and recycling; case studies demonstrating how small and medium California businesses have reduced greenhouse gas emissions; program financing resources; peer-networking opportunities; and an awards program to recognize reductions of greenhouse gas emissions among California businesses.

ARB will also continue working with the many business associations, organizations, and other State partners, such as the Small Business Advocate's AB 32 Small Business Task Force, the Labor and Workforce Development Agency, and Business, Transportation, and Housing Agency that have the resources, input and expertise to provide. These partners will help to further develop and implement an effective outreach plan to provide technical assistance to businesses through a variety of means, including attendance at business events, workshops, and working with local economic development agencies.

C. Implementation of the Plan

This Scoping Plan outlines the regulations and other mechanisms needed to reduce greenhouse gas emissions in California. ARB and other State agencies will work closely

with stakeholders and the public to develop regulatory measures and other programs to implement the Plan. ARB and other State agencies will develop any regulations in accordance with established rulemaking guidelines. Table 32 shows the status of the proposed measures in the plan.

Table 32: Status of Scoping Plan Measures

Existing Laws, Regulations, Policies And Programs
Light-Duty Vehicle Greenhouse Gas Standards (Pavley I)
Renewables Portfolio Standard (to 20%)
Solar Hot Water Heaters
Million Solar Roofs
High Speed Rail
Measures Strengthening & Expanding Existing Policies & Programs
Electricity Efficiency
Natural Gas Efficiency
Renewables Portfolio Standard (from 20% to 33%)
Sustainable Forests
Light-Duty Vehicle Greenhouse Gas Standards (Pavley II)
Discrete Early Actions
Low Carbon Fuel Standard
High GWP in Consumer Products (Adopted)
Smartways
Landfill Methane Capture
High GWP in Semiconductor Manufacturing
Ship Electrification (Adopted)
SF6 in non-electrical applications
Mobile Air Conditioner Repair Cans
Tire Pressure Program
New Measures
California Cap-and-Trade Program Linked to WCI Partner Jurisdictions
Increase Combined Heat and Power
Regional Transportation-Related GHG Targets
Goods Movement Systemwide Efficiency
Vehicle Efficiency Measures
Medium/Heavy Duty Vehicle Hybridization
High GWP Reductions from Mobile Sources
High GWP Reductions from Stationary Sources
Mitigation Fee on High GWP Gases
Oil and Gas Extraction
Oil and Gas Transmission
Refinery Flares
Removal of Methane Exemption from Existing Refinery Regulations

Rulemakings will take place over the next two years. As with all rulemaking processes, there will be ample opportunity for both informal interaction with technical staff in meetings and workshops, and formal interaction. ARB will consider all information and stakeholder input during the rulemaking process. Based on this information, ARB may modify proposed measures to reflect the status of technological development, the cost of the measure, the cost-effectiveness of the measures and other factors before presenting them to the Board for consideration and adoption.

In addition to these existing approaches, AB 32 imposes other requirements for the rulemaking process. Section 38562(b) explicitly added requirements for any regulations adopted for greenhouse gas emissions reductions. ARB also recognizes the need to expand the scope of analysis required when adopting future greenhouse gas emission reduction regulations. These expanded evaluations include the unique enforcement nature of climate change-related regulations and the possible extended permitting considerations and timelines that must be taken into account when establishing compliance dates. An important consideration in developing regulations will be the potential impact on California businesses. The potential for leakage, the movement of greenhouse gas emissions (and economic activity) out of state, will be carefully evaluated during the regulatory development.

As noted above, as the Scoping Plan is implemented and specific measures are developed, ARB and other implementing agencies will also conduct further CEQA analyses, including cumulative and multi-media impacts. ARB must design equitable regulations that encourage early action, do not disproportionately impact low-income and minority communities, ensure that AB 32 programs complement and do not interfere with the attainment and maintenance of ambient air quality standards, consider overall societal benefits (such as diversification of energy resources), minimize the administrative burden, and minimize the potential for leakage. AB 32 requires that, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emission limit, ARB must consider the potential for direct, indirect and cumulative emission impacts from market-based compliance mechanisms, including localized impacts in communities that are already adversely impacted by air pollution, design the program to prevent any increase in emissions, and maximize additional environmental and economic benefits prior to the inclusion of market-based compliance mechanisms in the regulations. As ARB further develops its approach for consideration of these issues in future rulemakings, and updates needed analytical tools and data sets, we will consult with outside experts and the EJAC.

ARB already conducts robust environmental and environmental justice assessments of our regulatory actions. Many of the requirements in AB 32 overlap with ARB's traditional evaluations. In adopting regulations to implement the measures recommended in the Scoping Plan, or including in the regulations the use of market-based compliance mechanisms to comply with the regulations, ARB will ensure that the measures have undergone the aforementioned screenings and meet the requirements established in HSC §38562 (b) (1-9) and §38570 (b) (1-3).

D. Tracking and Measuring Progress

Many State agencies, working with the diverse set of greenhouse gas emissions sources, have collaborated in the process of developing the strategies presented in this plan. As the agency responsible for ensuring that AB 32 requirements are met, ARB must track the regulations adopted and other actions taken by both ARB and other State agencies as the plan is implemented.

The emissions reductions enumerated in this plan are estimates that may be modified based on additional information. As the proposed measures are developed over the coming years, it is possible that some of these strategies will not develop as originally thought or not be technologically feasible or cost-effective at the level given in the plan. It is equally likely that new technologies and strategies will emerge after the initial adoption schedule required in AB 32, that is, regulation adoption by January 1, 2011. If promising new tools or strategies emerge, ARB and other affected State agencies will evaluate how to incorporate the new measures into the AB 32 program. In this way, new strategies ensuring that the commitments in the plan remain whole and that the 2020 goal can be met will be incorporated into the State strategy.

ARB will update the plan at least once every five years (HSC §38561(h)). These updates will allow ARB to evaluate the progress made toward the State's greenhouse gas emission reduction goals and correct the Plan's course where necessary. This section discusses the tracking and measurement of progress that ARB envisions. The Report Cards and audits, along with an evaluation of new technologies – both emerging and those recently incorporated into the Plan – will also provide valuable input into ARB's update process. Continuous atmospheric monitoring of greenhouse gases may also be useful for determining the effectiveness of emission reduction strategies and for future inventory development.

1. Report Card

SB 85 (Budget Committee, Chapter 178, Statutes of 2007) requires every State agency to prepare an annual "Report Card," detailing measures the agency has adopted and taken to reduce greenhouse gas emissions, including the actual emissions reduced as a result of those actions. The information must be submitted to CalEPA, which is then required to compile all the State agency data into a report format, which is made available on the Internet and submitted to the Legislature. The information allows comparisons of each agency's projected and actual greenhouse gas emissions reductions with the targets established by the CAT or the Scoping Plan. This would be the State's 'Report Card' on its efforts to reduce greenhouse gas emissions.

Agencies are also required, as funds are available, to have an outside audit of greenhouse gas-related actions completed every three years to verify actual and projected reductions.

2. Tracking Progress by Implementing Agencies

As the lead agency responsible for implementing AB 32, ARB must track the progress of both our efforts and the efforts of our partners in implementing their respective provisions of this plan. Communication between ARB and the other implementing agencies will be especially important as regulations and programs are developed. In support of the Report Card requirement noted above, ARB will work with CalEPA to develop a process to track and report on progress toward the plan's goals and commitments.

3. Progress Toward the State Government Target

The CAT recently established a State Government Subgroup to work with State agencies to create a statewide approach to meet the Scoping Plan's commitment to reduce greenhouse gas emissions by a minimum of 30 percent by 2020 below the State's estimated business-as-usual emissions – approximately a 15 percent reduction from current levels. State agencies must lead by example by doing their part to reduce emissions and employ practices that can also be transferred to the private sector. The statewide plan will serve as a guide for State agencies to achieve realistic, measurable objectives within specific timelines. This newly created State Government Subgroup will assist State agencies through these steps in a timely manner.

4. Mandatory Reporting Regulation

ARB's mandatory reporting rule, adopted in December 2007, will help the State obtain facility-level data from the largest sources of greenhouse gas emissions in California. This data will help ARB better understand these sources to develop the proposed emissions reduction measures outlined in this plan.

The regulation requires annual reporting from the largest facilities in the state, accounting for 94 percent of greenhouse gas emissions from industrial and commercial stationary sources in California. There are approximately 800 separate sources that fall under the new reporting rules, which include electricity generating facilities, electricity retail providers and power marketers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and industrial sources that emit over 25,000 tons of carbon dioxide each year from on-site stationary source combustions such as large furnaces. This last category includes a diverse range of facilities such as food processing, glass container manufacturers, oil and gas production, and mineral processing.

Affected facilities will begin tracking their greenhouse gas emissions in 2008, to be reported beginning in 2009 with a phase-in process to allow facilities to develop reporting systems and train personnel in data collection. Emissions for 2008 may be based on best available data. Beginning in 2010, emissions reports will be more rigorous and will be subject to third-party verification. Reported emissions data will allow ARB to improve its facility-based emissions inventory data. Originally, the statewide greenhouse gas inventory was based on aggregated sector data and could

not be broken down to the facility level. The facility-level reporting required under the Mandatory Reporting regulation will improve data on greenhouse gas emissions for individual facilities and their emitting processes. This information could also help improve emissions inventories for criteria pollutants, and provide additional data for assessing cumulative emission impacts on a community level.

ARB emissions reporting requirements are expected to be modified over time as AB 32 is implemented.

E. Enforcement

Enforcement is a critical component of all of the State's regulatory programs, both to ensure that emissions are actually reduced and to provide a level playing field for entities complying with the law. To meet the 2020 target this plan calls for aggressive action by a number of State agencies. Each of those agencies will employ its full range of compliance and enforcement options to ensure that planned reductions are achieved. The remainder of this section discusses ARB's portion of the enforcement program in more detail.

ARB has an extensive and effective enforcement program covering a wide variety of regulated sources, from heavy-duty vehicle idling, to consumer products, to fuel standards and off-road equipment. To increase the effectiveness of its enforcement efforts and provide greater assurance of compliance, ARB also partners with local, State and federal agencies to carry out inspections and, when necessary, prosecute violators.

ARB will continue its strong enforcement presence as the State's primary air pollution control agency. A critical function of this responsibility is to ensure that all enforcement actions are timely, effective, and appropriate with the severity of the situation. ARB will also continue its close working relationship with local air districts in the development and enforcement of applicable regulations contained within the Scoping Plan and collaborate with the appropriate State agencies on greenhouse gas emission reductions measures.

For the stationary source regulations called for in the plan, ARB will work closely with the local air districts that have primary responsibility for implementing and enforcing criteria pollutant regulations. Not only are local air districts familiar with the individual facilities and their compliance history, but information contained in district permits can be used to verify the accuracy of greenhouse gas emissions reported by sources subject to ARB mandatory reporting requirements. Using this data, regulators can also examine any correlation between greenhouse gases and toxic or criteria air pollutants as a result of emissions trading or direct regulations.

ARB will also continue to partner with the California Highway Patrol and other State and local enforcement agencies on mobile source and other laws and regulations where joint enforcement authorities apply.

Although many of the measures in the Scoping Plan are modeled on existing ARB regulations, a multi-sector, regional cap-and-trade program would bring unique enforcement challenges. ARB and CalEPA have begun the process of engaging and consulting with other State agencies, such as California's Department of Justice, Public Utilities Commission, Energy Commission, as well as the Independent System Operator, on market tracking and enforcement. These working group meetings are ongoing and will culminate in a comprehensive enforcement plan to accompany the proposed cap-and-trade program when the Board considers regulatory requirements. This enforcement plan would describe the administrative structures needed for market monitoring, prosecution, and penalty setting. Public input regarding these issues would also be a key part of the public stakeholder process conducted during development of the cap-and-trade programs regulations.

Accurate measurement and reporting of all emissions would be necessary to assure accountability, establish the integrity of allowances, and provide sufficient transparency to sustain confidence in the market. To ensure compliance, ARB would administer penalties for entities that hold an insufficient quantity of allowances to cover their emissions or fail to report their greenhouse gas emissions. Missed compliance deadlines would also result in the application of stringent administrative, civil, or criminal penalties.

This plan recommends that California implement a cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system. This system would require California to formalize enforcement agreements with its WCI partner jurisdictions for all phases of cap-and-trade program operations, including verification of emissions, certification of offsets based on common protocols, and detection of and punishment for non-compliance. As needed, California would also work with federal regulatory and enforcement agencies that oversee trading markets, such as the Commodity Futures Trading Commission and the Federal Energy Regulatory Commission. While California would work with other jurisdictions on joint enforcement activities, ARB will exercise all of its authority under HSC §38580 and other provisions of law to enforce its regulations against any violator wherever they may be.

F. State and Local Permitting Considerations

Some of the proposed emissions reduction strategies in this Scoping Plan may require affected entities to modify or obtain state or local permits. California's existing permit process ensures that health and safety concerns are evaluated, met, and when appropriate, mitigated. The State recognizes the potential for conflicts between various federal, state and local permitting requirements, which may cross various media – air, water, etc. CalEPA is actively involved in identifying and addressing these regulatory overlap issues with the ultimate goal of consolidating permits where feasible while maintaining all permit requirements. Two such examples are CalEPA's digester permit working group and the CalEPA-Air District Compost Emissions Work Group.

ARB recognizes that the permitting process may affect the viability of certain strategies and that the length of the permitting process could affect the timing of emissions reductions.

ARB, along with CalEPA and other State agencies, will continue to evaluate steps to ensure that permit requirements harmonize across the affected media.

This Plan has been developed with an understanding of the important cross-media impacts. These efforts will continue during the implementation of the Plan. Particular focus on the potential permitting impacts and cross-media consequences of a proposed rule will take place during the rulemaking process.

G. Role of Local Air Districts

Local air districts are ARB's partners in addressing air pollution. ARB takes primary responsibility for transportation, off-road equipment and consumer products. Local districts lead in controlling industrial, commercial and other stationary sources of air emissions. AB 32 recognizes the need to develop a program that meshes with local and regional activities. Although AB 32 does not provide an explicit role for air districts, their local presence as advocates for clean air and their resources, experience and expertise in regulating and enforcing rules for stationary sources make them a logical choice to have an important role in several aspects of implementing California's greenhouse gas program. ARB would partner with local air districts to develop and effectively enforce both source-specific requirements on industrial sources, and to enforce related programs, such as the high GWP rules, that affect a large number of local businesses.

ARB and local air districts are also actively working to coordinate emission reporting requirements. Some districts, like the South Coast Air Quality Management District, have developed software to allow their industrial sources to simultaneously report their criteria pollutant emissions to the District and their greenhouse gas emissions to ARB. Many air district staff are being trained as third-party verifiers to confirm the greenhouse gas emissions information provided by industrial sources under the mandatory reporting regulation, and, similarly, could provide verification of voluntary greenhouse gas reductions in the future.

Local air districts will be key in both encouraging greenhouse gas emissions reductions from other regional and local government entities, and providing technical assistance to quantify and verify those reductions. Local agencies are an important component of ARB's outreach strategy.

Many local air districts have already taken a leadership role in addressing greenhouse gas emissions in their communities. These efforts are intended to encourage early voluntary reductions. For example, local districts are "lead agencies" under the California Environmental Quality Act (CEQA) for some projects. In order to ensure high-quality mitigation projects, some districts have established programs to encourage local greenhouse gas reductions that could be used as CEQA mitigation. As the State begins to institutionalize mechanisms to generate and verify greenhouse gas emissions reductions, ARB and the districts must work together to smoothly transition to a cohesive statewide program with consistent technical standards.

H. Program Funding

Administration, implementation, and enforcement of the emissions reduction measures contained in the Scoping Plan will require a stable and continuing source of funding. AB 32 authorizes ARB to collect fees to fund implementation of the statute. ARB recently initiated a rulemaking for a fee program to fund administration of the program.

Approximately $36 million per year will be needed on an ongoing basis to fund implementation by ARB and other State agencies, based on the positions and funding included in the 2009-2010 fiscal year budget. Additional revenues are needed to repay the loans from State funds that were used to pay ARB and CalEPA expenses in the startup of the program. ARB is moving on an expedited schedule to develop a fee regulation and expects to take a regulation to the Board in mid 2009, with the aim of beginning to collect fees in the 2009/2010 fiscal year.

V. A VISION FOR THE FUTURE

California has the know-how, ingenuity, research capabilities, and culture of innovation to meet the challenge of addressing climate change. However, reaching the goals we have set for ourselves will not be easy. Successful implementation of many of the proposed programs and measures described in this plan will require strong leadership and a shared understanding of the need to reach viable and lasting solutions quickly.

This challenge will also require establishing a wide range of partnerships, both within California and beyond our borders. We will need to support additional research, and further develop our culture of innovation and technological invention. In order to continue the momentum and the commitment to a clean energy future, we will need to both build on existing solutions and develop new ones.

The following sections lay out some of the elements that will be necessary to forge a broad-based institutional strategy to address climate change both within California and beyond. Also discussed is the need to build partnerships on the regional, national and international levels to ensure that our actions complement and support those being taken on a global scale. This section also looks forward to 2030, showing that California is on the trajectory needed to do our part to stabilize global climate.

A. Collaboration

1. Working Closely with Key Partners

True climate change mitigation will require many parties to work together for a global mitigation plan. California and other states are filling a vacuum created by the current lack of leadership at the federal level. By its bold actions, California is moving the United States closer to a seat at the table among the developed countries that have agreed to reduce their carbon emissions, and lead a new international effort for an agreement to replace the Kyoto Protocol that expires in 2012.

Any national climate program must be built on a partnership with State and local governments to ensure that states can continue their role as incubators of climate change policy and can implement effective programs such as vehicle standards, energy efficiency programs, green building codes, and alternative fuel development.

California will work for climate solutions with key federal agencies, including the U.S. Department of Energy and their national labs, the U.S. Environmental Protection Agency, the U.S. Bureau of Land Management, the U.S. Department of Agriculture, the U.S. Department of Transportation, and others.

Through the Western Climate Initiative and in collaboration with other regional alliances of states, California can promote its own best practices and learn from others while helping to formulate the structure of a regional and ultimately national cap-and-trade program.

2. International

As one of the largest economies in the world, California is committed to working at the international level to reduce global greenhouse gas emissions. As part of this effort, Governor Schwarzenegger and other U.S. governors taking the lead in climate change are co-hosting a Global Climate Summit on Finding Solutions Through Regional and Global Action. This summit, held on November 18th and 19th, 2008, began a state-province partnership with leaders from the U.S., Australia, Brazil, Canada, China, India, Indonesia, Mexico, the European Union, and other nations, taking urgent steps to contain global climate change and jointly setting forth a blueprint for the next global agreement on climate change solutions.

California is also a charter member of the International Carbon Action Partnership (ICAP), an organization composed of countries and regions that have adopted carbon caps and that are actively pursuing the implementation of carbon markets through mandatory cap-and-trade systems. California's continued involvement in ICAP will be very beneficial for sharing experiences and knowledge as we design our own market program.

In addition to participating in ICAP, California hopes to engage developing countries to pursue a low-carbon development path. With developing nations expected to suffer the most from the effects of climate change, California and others have an obligation to share information and resources on cost-effective technologies and approaches for mitigating both emissions and future impacts as changes in climate and the environment occur.

California recognizes the "common but differentiated responsibilities" among developed and developing countries (as articulated in the Kyoto Protocol), but the reality is that rapidly escalating greenhouse gas emissions in developing countries could possibly negate any efforts undertaken in California. To the extent that we are part of the global economy, California's demand for goods manufactured in developing countries further exacerbates growth of greenhouse gas emissions globally. Therefore, it is critical for California to help support the adoption of low-carbon technologies and sustainable development in the developing world.

California can advance the international policy debate through state-provincial partnerships for achieving early climate action in developing countries. This approach envisions commitments by developed countries to provide capacity building through technological assistance and investment support in return for developing countries adopting enhanced mitigation actions. California will consider working with developing countries or provinces that have, at a minimum, pledged to achieve greenhouse gas intensity targets in certain carbon-intensive sectors through

mechanisms, such as minimum performance standards or sector benchmarks. California also recognizes that developing countries have the challenge and responsibility to reduce domestic emissions in a way that will promote sustainable development, but not undermine their economic growth.

One possible manifestation of these collaborations could be the establishment of sectoral agreements that help to grow developing countries' economies in a low-carbon manner. In a sectoral approach, energy-intensive sectors adopt programs for reducing greenhouse gas emissions and/or energy use. Such sector-based approaches seem likely to win the support of developing countries and could also reduce concerns in developed countries about international competitiveness and carbon leakage.

A state-provincial partnership related to imported commodities (such as cement) would enable California to provide incentives to reduce greenhouse gas emissions associated with products that are imported by our state. California should continue to develop current relations and existing partnership arrangements with China – now the largest emitter of greenhouse gases in the world – because in addition to other compelling reasons much of the state's imported cement originates in China. California should also work to establish similar relations with India and other countries to share research on both greenhouse gas mitigation and climate change adaptation activities. Projects in the Mexican border region may also be of particular interest, considering the opportunity to realize considerable co-benefits on both sides of the border.

Deforestation accounts for approximately 20 percent of global greenhouse gas emissions. California has set a strong precedent in the effort to incorporate forest management and conservation into climate policy by adopting the CCAR forest methodology in October 2007. California also hopes to engage developing countries, including Brazil and Indonesia, to reduce emissions and sequester carbon through eligible forest carbon activities. Activities aimed at Reducing Emissions from Deforestation and Forest Degradation (REDD) were excluded from the rules governing the first Kyoto commitment period, but there is considerable momentum behind the effort to include provisions that would recognize such activities in a post-2012 international agreement. Providing incentives to developing countries to help cut emissions by preserving standing forests, and to sequester additional carbon through the restoration and reforestation of degraded lands and forests and improved forest management practices, will be crucial in bringing those countries into the global climate protection effort. California recognizes the importance of establishing mechanisms that will facilitate global partnerships and sustainable financing mechanisms to support eligible forest carbon activities in the developing world.

B. Research

1. Unleash the Potential of California's Universities and Private Sector

Bringing greenhouse gas emissions down to a level that will allow the climate to stabilize will take a generation or longer. Many of the ultimate solutions to achieve stabilization will be developed and implemented well into the future. Innovation in energy and climate will come from people who are now in school. These young people will face unprecedented challenges, and they will need both wisdom and imagination to craft solutions. California's respected public and private academic institutions must continue to develop and fund programs based on climate change science that cut across disciplines to address the multi-dimensional aspects of climate change.

2. Public-Private Partnerships

To most effectively address the climate change dilemma, we must encourage collaborations between academia and the private sector. Industry is well-positioned to quickly attack problems. Combining the vast knowledge housed in universities with businesses' acumen and agility can unleash a powerful collaborative force to tackle the problems associated with climate change.

Several important programs have already been initiated at California universities, including Stanford's Global Climate and Energy Project and the University of California at Berkeley's Energy Biosciences Institute (EBI).[81] These and other efforts need to be recognized and encouraged, along with others that can link the results of research directly to policy decisions that the State must make.

Carbon Sequestration

In addition to terrestrial carbon sequestration or natural carbon sinks, such as forests and soil, CO_2 can be prevented from entering the atmosphere through carbon capture and storage (CCS). This consists of separating CO_2 from industrial and energy-related sources and transporting the CO_2 to a storage location for long-term isolation from the atmosphere. Potential technical storage methods include geological storage, industrial fixation of CO_2 into inorganic carbonates, and other strategies. Large point sources of CO_2 that may pursue CCS include large power plants, fossil fuel-based hydrogen production plants, and oil refineries.[82]

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[81] The EBI is being developed in cooperation with Lawrence Berkeley National Laboratory, the University of Illinois at Urbana-Champaign and BP.

[82] Intergovernmental Panel on Climate Change. *Carbon Dioxide Capture and Storage: A Special Report of Working Group III of the IPCC*. Cambridge University Press, UK; 2005. http://www.ipcc.ch/ipccreports/srccs.htm (accessed October 12, 2008)

According to a 2005 report by the Intergovernmental Panel for Climate Change (IPCC), a power plant with CCS could reduce CO_2 emissions to the atmosphere by approximately 80 to 90 percent compared to a plant without CCS (including the energy used to capture, compress and transport CO_2).[83] While more research and development needs to occur, California should both support near-term advancement of the technology and ensure that an adequate framework is in place to provide credit for CCS projects when appropriate.

The State is currently an active member of the West Coast Regional Carbon Sequestration Partnership (WESTCARB), a public-private collaboration to characterize regional carbon sequestration opportunities in seven western states and one Canadian province. Established in 2003, this research project is comprised of more than 80 public and private organizations. WESTCARB is conducting technology validation field tests, identifying major sources of CO_2 in its territory, assessing the status and cost of technologies for separating CO_2 from process and exhaust gases, and determining the potential for storing captured CO_2 in secure geologic formations.[84]

C. Reducing California's Emissions Further – A Look Forward to 2030

In order to assess whether implementing this plan achieves the State's long-term climate goals, we must look beyond 2020 to see whether the emissions reduction measures set California on the trajectory needed to do our part to stabilize global climate.

Governor Schwarzenegger's Executive Order S-3-05 calls for an 80 percent reduction below 1990 greenhouse gas emission levels by 2050. This results in a 2050 target of about 85 $MMTCO_2E$ (total emissions), as compared to the 1990 level (also the 2020 target) of 427 $MMTCO_2E$. Climate scientists tell us that the 2050 target represents the level of greenhouse gas emissions that advanced economies must reach if the climate is to be stabilized in the latter half of the 21st century. Full implementation of the Scoping Plan will put California on a path toward these required long-term reductions. Just as importantly, it will put into place many of the measures needed to keep us on that path.

Figure 6 depicts what an emissions trajectory might look like, assuming California follows a linear path from the 2020 AB 32 emissions target to the 2050 goal needed to help stabilize climate. While the measures needed to meet the 2050 goal are too far in the future to define in detail, we can examine the policies needed to keep us on track through at least 2030.

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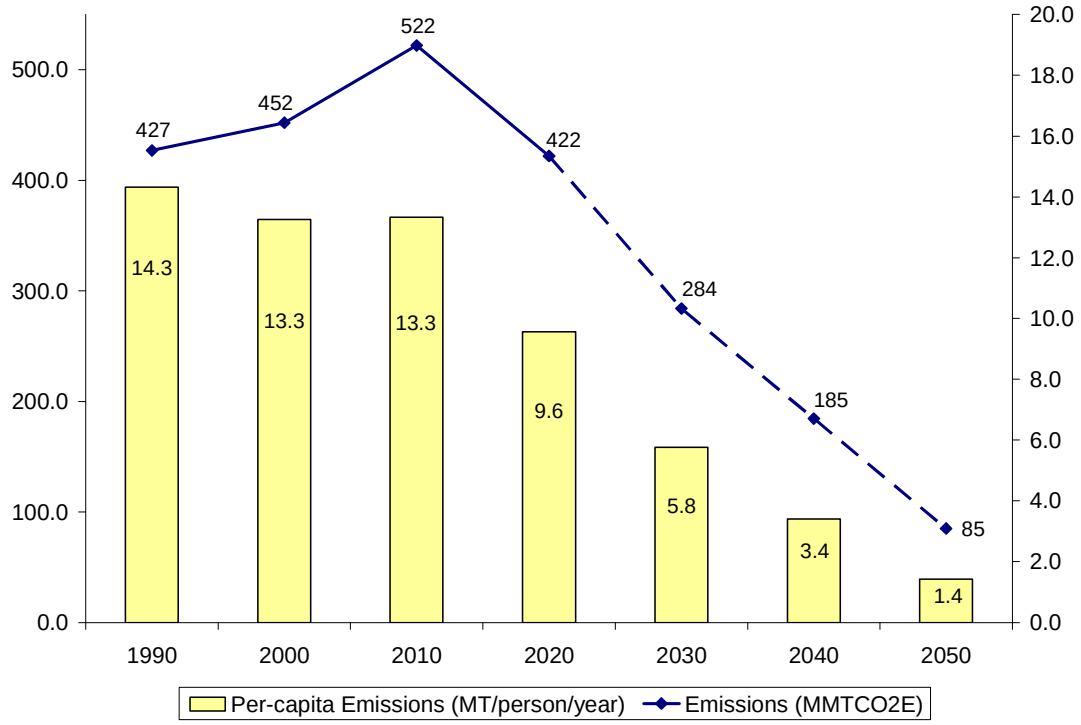
[83] Ibid

[84] WESTCARB. *WESTCARB Overview*. http://www.westcarb.org/about_overview.htm (accessed October 12, 2008)

Figure 6: Emissions Trajectory Toward 2050



To stay on course toward the 2050 target our State's greenhouse gas emissions need to be reduced to below 300 $MMTCO_2E$ by 2030. This translates to an average reduction of four percent per year between 2020 and 2030. An additional challenge comes from the fact that California's population is expected to grow by about 12 percent between 2020 and 2030. To counteract this trend, per-capita emissions must decrease at an average rate of slightly less than five percent per year during the 2020 to 2030 period.

Are such reductions possible by 2030? What measures might be able to provide the needed reductions? How do the needed measures relate to the efforts put into place to reach the 2020 goal? All of these are critical questions, and are addressed below.

The answer to the first question is yes, the reductions are possible. Furthermore, the measures needed are logical expansions of the programs recommended in the Scoping Plan that get us to the 2020 goal. We could keep on track through 2030 by extending those programs in the following ways:

- Using a regional or national cap-and-trade system to further limit emissions from the 85 percent of greenhouse gas emissions in capped sectors (Transportation Fuels and other fuel use, Electricity, Residential/Commercial Natural Gas, and Industry). By 2030 a comprehensive cap-and-trade program could lower emissions in the capped sectors from 365 $MMTCO_2E$ in 2020 to around 250 $MMTCO_2E$ in 2030;

- Achieving a 40 percent fleet-wide passenger vehicle reduction by 2030, approximately double the almost 20 percent expected in 2020;
- Increasing California's use of renewable energy;
- Reducing the carbon intensity of transportation fuels by 25 percent (a further decrease from the 10 percent level set for 2020);
- Increasing energy efficiency and green building efforts so that the savings achieved in the 2020 to 2030 timeframe are approximately double those accomplished in 2020; and
- Continuing to implement sound land use and transportation policies to lower VMT and shift travel modes.

The effects of these strategies are presented in Table 33.

Table 33: Potential Distribution of California Greenhouse Gas Emissions by Sector in 2030

Sector	Potential Emissions ($MMTCO_2E$)
Transportation Fuels*	102
Other Fuel Use*	149
Uncapped Sectors	33
Total	**284**

* Capped sector

With these polices and measures in place, per-capita electricity consumption would decrease by another five percent. Well over half of our electricity demand could be met with zero or near zero greenhouse gas emitting technologies, assuming nuclear and large hydro power holds constant at present-day levels. In response to a lower cap on emissions, existing coal generation contracts would not be renewed, or carbon capture and storage would be utilized to minimize emissions. The remaining electricity generation would come from natural gas combustion either in cogeneration applications or from highly efficient generating units.

By 2030, the transportation sector would undergo a similarly massive transition both in terms of the vehicle fleet and the diversity of fuel supplies. Due to the combination of California's clean car standards (ARB's ZEV program and the Low Carbon Fuel Standard), the number of battery-electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles would increase dramatically, to about a third of the vehicle fleet. Flex-fuel vehicles would comprise a large fraction of the remaining fleet, with more efficient gasoline and diesel vehicles making up the difference. Electricity, advanced biofuels, improved gasoline and diesel, renewable natural gas and hydrogen would all play a role in powering this high-tech fleet of efficient vehicles.

Regional land use and transportation strategies would grow in importance and would reverse the trend of per-capita vehicle miles traveled, a reduction of about eight percent below business-as-usual in 2030. With ambitious but reasonable action, statewide passenger vehicle greenhouse gas emissions could be reduced to half of 2020 levels in 2030, which is also about half of business-as-usual for 2030. Efficiency strategies and low carbon fuels for heavy-duty and off-road vehicles, as well as for ships, rail, and aviation, would need to be greatly expanded in order to achieve additional reductions from the transportation sector in 2030.

In tandem with efficiency measures that lower demand for electricity, natural gas and transportation fuels, California's cap-and-trade program would incent large industrial sources as well as commercial and residential natural gas customers to further reduce emissions. By tightening the cap over time, it is expected that facilities in the industrial and natural gas sectors would achieve reductions well beyond those needed to meet the 2020 emissions cap.

The Scoping Plan proposes several measures for reducing high GWP gases that collectively, will substantially reduce emissions. With a transition toward reduced consumption of these gases, improved containment in their end uses, and substitution of low GWP alternative gases, it is expected that emissions from this sector could decrease by 75 percent between 2020 and 2030.

For uncapped sectors, we assume that the agriculture sector will reduce emissions by about 15 percent between 2020 and 2030. Net forest uptake of CO_2 must be preserved or enhanced, likely through both expansion of forests and reduction in carbon loss from forest fires, which are predicted to increase over this time period. This example assumes a 10 percent reduction in direct landfill emissions from the recycling and waste sector; however, aggressive implementation of the suite of measures proposed in this Plan could further reduce emissions from this sector by 2030.

In total, the measures described above would produce reductions to bring California's statewide greenhouse gas emissions to an estimated 284 $MMTCO_2E$ in 2030. While the potential mix of future climate policies articulated in this section is only an example, it serves to demonstrate that the measures in the Scoping Plan can not only move California to its 2020 goal, but also provide an expandable framework for much greater long-term greenhouse gas emissions reductions.

D. Conclusion

California's commitment to address global warming has never been greater. The vast amount of interest, support, and input that ARB has received since this plan began to take shape is evidence of a clear understanding of the need to take action and support for the State's efforts to lead the way. The time has come to shift away from a 'business-as-usual' approach to climate change and to move toward the lasting and sustainable goal of a clean energy future.

Reaching our goals will take a great deal of leadership, commitment, and a willingness to embrace new approaches and seek out new solutions. California's plan to reduce greenhouse gas emissions must also take into account the impacts of this transition and be designed in particular to address the needs of low-income communities, small businesses, and California's working families.

Reaching our goals will also require involvement and support from all levels of government in California, and a coordinated effort with other states, regions, and countries. The solutions and technologies we develop here will be used around the world to help others transition to a clean energy future and contribute to the fight against global warming.

Reaching our goals will also require flexibility. As we move forward, we must be prepared to make mid-course corrections. AB 32 wisely requires ARB to update its Scoping Plan every five years, thereby ensuring that California stays on the path toward a low carbon future.

This plan is part of a new chapter for California that in many ways began with the passage and signing of AB 32. It proposes a comprehensive set of actions designed to reduce greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health. The challenge California has taken on is large but the opportunities are even greater. It is now time to turn this plan into action.

ACKNOWLEDGMENTS

This Scoping Plan was prepared by the Air Resources Board. This document was made possible by the hard work of numerous contributors. Below is a list of advisory committees and State agencies that directly provided input to this Scoping Plan.

Team Support

Climate Action Team

Climate Action Team Sector Subgroups

- Agriculture
- Cement
- Energy
- Forest
- Green Buildings
- Land Use
- Recycling and Waste Management
- State Fleet
- Water-Energy
- Economics

Advisory Committees

Market Advisory Committee

Environmental Justice Advisory Committee

Economic and Technology Advancement Advisory Committee

State Agencies

Governor's Office of Planning and Research

California Environmental Protection Agency

Business, Transportation and Housing Agency

Resources Agency

State and Consumer Services Agency

Department of Food and Agriculture

California Energy Commission

California Public Utilities Commission

California Transportation Commission

Department of Conservation

Department of Forestry and Fire Protection

Department of General Services

Department of Parks and Recreation

Department of Public Health

Department of Toxic Substances Control

Department of Transportation

Department of Water Resources

Housing and Community Development

Integrated Waste Management Board

Office of Environmental Health Hazard Assessment

State Water Resources Control Board

Department of Pesticide Regulation

BOARD RESOLUTION

State of California
Air Resources Board

Climate Change Scoping Plan

Resolution 08-47

December 11, 2008

Agenda Item No.: 08-10-2

WHEREAS, the Legislature has enacted the Global Warming Solutions Act of 2006 (AB 32; Health and Safety Code section 38500 et seq.), which declares that global warming poses a serious threat to the environment of California and creates a comprehensive multi-year program to reduce greenhouse gas (GHG) emissions that cause global warming;

WHEREAS, the adverse impacts of climate change include more droughts, more frequent and extreme heat waves, erratic storm and flood events, decreases in winter snowpack, a rise in sea level, increases in water temperatures, an increase in coastal erosion, intrusion of sea water, an increase in the duration of wildfire season, and increased occurrences of unhealthy ozone levels;

WHEREAS, climate change mitigation and adaptation measures can be complementary and are often intricately linked;

WHEREAS, AB 32 designates the Air Resources Board (ARB or the Board) as the State agency charged with monitoring and regulating sources of GHG emissions in California in order to reduce these emissions;

WHEREAS, section 38561(a) of the Health and Safety Code directs the Board, on or before January 1, 2009, to prepare and approve a Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions by 2020;

WHEREAS, section 38561(a) of the Health and Safety Code also requires ARB to consult with all State agencies having jurisdiction over sources of GHGs on all elements of the Scoping Plan that pertain to energy-related matters, to ensure reduction activities adopted and implemented by ARB are complementary, non-duplicative and can be implemented in an efficient and cost-effective manner;

WHEREAS, section 38561(b) of the Health and Safety Code requires the Scoping Plan to identify and make recommendations on direct emission reduction measures, alternative compliance mechanisms, market-based compliance mechanisms, and potential monetary and nonmonetary incentives for sources and categories of sources that the Board finds necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of GHG emissions by 2020;

WHEREAS, section 38561(c) of the Health and Safety Code requires ARB to consider all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada and the European Union in making the determinations required in Health and Safety Code section 38561(b);

WHEREAS, section 38561(d) of the Health and Safety Code requires ARB to evaluate the total potential costs and total potential economic and noneconomic benefits of the Scoping Plan to California's economy, environment, and public health, using the best available economic models, emissions estimation techniques, and other scientific methods;

WHEREAS, section 38561(e) of Health and Safety Code requires ARB, in developing its plan, to take into account the relative contribution of each source or source category to statewide GHG emissions, and the potential for adverse effects on small businesses, and to recommend a de minimis threshold of GHG emissions below which emission reduction requirements will not apply;

WHEREAS, section 38561(f) of the Health and Safety Code requires ARB, in developing its plan, to identify opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, including, but not limited to, carbon sequestration projects and best management practices;

WHEREAS, section 38561(g) of the Health and Safety Code requires ARB to conduct a series of public workshops to give interested parties an opportunity to comment on the Scoping Plan, and that a portion of these workshops should take place in regions that have the most significant exposure to air pollution, including, but not limited to communities with minority populations, communities with low-income populations, or both;

WHEREAS, section 38652(b) of the Health and Safety Code requires ARB, in adopting greenhouse gas regulations, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, to design the regulations in a manner that is equitable and seeks to minimize costs and maximize the total benefits to California; ensure that activities taken to comply with the regulations do not disproportionately impact low-income communities; ensure that activities undertaken pursuant to the regulations complement efforts to achieve and maintain ambient air quality standards and to reduce toxic air contaminant emissions; consider the cost-effectiveness of the regulations; consider overall societal benefits; minimize administrative burden; and minimize leakage;

WHEREAS, section 38565 of the Health and Safety Code requires ARB to ensure that greenhouse gas emission reduction rules, regulations, programs, mechanisms and incentives under ARB's jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California;

WHEREAS, sections 39600 and 39601 of the Health and Safety Code authorize the ARB to adopt standards, rules and regulations and to do such acts as may be necessary for the proper execution of the powers and duties granted to and imposed upon the ARB by law;

WHEREAS, ARB has adopted and is implementing numerous programs to reduce criteria pollutants, diesel particulate, and air toxics emissions, including the 2007 State Implementation Plan, the Goods Movement Emissions Reduction Plan, and the Diesel Risk Reduction Plan;

WHEREAS, local air pollution control and air quality management districts are currently responsible for implementing many programs that regulate air pollution from stationary and area sources;

WHEREAS, the Board acknowledges the importance of ensuring adequate and reliable energy supplies while the State implements AB 32;

WHEREAS, in preparing the Proposed Scoping Plan, ARB staff considered advice and input from the Environmental Justice Advisory Committee and the Economic and Technology Advancement Advisory Committee;

WHEREAS, in June 2008 ARB staff prepared and circulated for public review a *Draft Climate Change Scoping Plan* (Draft Plan); staff then held three public workshops to discuss the Draft Plan, considered public comments received on the Draft Plan, and modified the Draft Plan in response to these comments;

WHEREAS, in October 2008 ARB staff prepared and circulated for public review a *Proposed Climate Change Scoping Plan*, in accordance with the requirements set forth in Health and Safety Code section 38561;

WHEREAS, the California Environmental Quality Act (CEQA) requires that no project which may have significant adverse environmental impacts may be adopted as originally proposed if feasible alternatives or mitigation measures are available to reduce or eliminate such impacts, unless specific overriding considerations are identified which outweigh the potential adverse consequences of any unmitigated impacts;

WHEREAS, CEQA allows public agencies to prepare a plan or other written documentation in lieu of an environmental impact report (i.e., a functional equivalent environmental document), once the Secretary of the Resources Agency has certified an agency's regulatory program pursuant to section 21080.5 of the Public Resources Code;

WHEREAS, pursuant to section 21080.5 of the Public Resources Code, the Secretary of the Resources Agency has certified that portion of ARB's regulatory program that

involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans;

WHEREAS, Board regulations under ARB's certified regulatory program provide that prior to taking final action on any proposal for which significant environmental issues have been raised, the decision maker shall approve a written response to each such issue;

WHEREAS, on October 15, 2008, ARB staff prepared and circulated for public review, in accordance with CEQA and Board regulations, a functional equivalent environmental document which is set forth in Appendix J to the *Proposed Climate Change Scoping Plan*;

WHEREAS in consideration of the *Proposed Climate Change Scoping Plan*, the written and oral testimony presented by the public, industry and government agencies, and the environmental documentation prepared by Board staff, the Board finds that:

1. ARB staff has consulted with all State agencies, including the Public Utilities Commission (PUC) and the State Energy Resources Conservation and Development Commission (CEC), having jurisdiction over sources of greenhouse gases on all elements of the Plan that pertain to energy-related matters, as required by Health and Safety Code section 38561(a);

2. ARB has carefully considered the joint opinion adopted by the PUC and CEC on October 17, 2008, which recommends strategies to help reduce greenhouse gas emissions from the electricity and natural gas sectors;

3. The recommendations in the *Proposed Scoping Plan* are necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of greenhouse gas emissions by 2020;

4. ARB has considered all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada and the European Union, as provided in Health and Safety Code section 38561(c);

5. ARB staff prepared an analysis to evaluate the total potential costs and total potential economic and noneconomic benefits of the *Proposed Climate Change Scoping Plan* to California's economy, environment, and public health; this analysis was prepared using the best available economic models, emissions estimation techniques, and other scientific methods, as required by Health and Safety Code section 38561(d);

6. In developing the *Proposed Climate Change Scoping Plan*, ARB took into account the relative contribution of each source or source category to

statewide GHG emissions, and the potential for adverse effects on small businesses, as provided in Health and Safety Code section 38561(e);

7. The *Proposed Climate Change Scoping Plan* recommends a de minimis threshold of GHG emissions below which emission reduction requirements will not apply, as provided in Health and Safety Code section 38561(e);

8. The *Proposed Climate Change Scoping Plan* identifies opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, as provided in Health and Safety Code section 38561(f);

9. In accordance with Health and Safety Code section 38561(g), ARB staff organized over 250 public workshops, workgroup events and formal meetings throughout the State, and participated in over 350 meetings and conferences involving external stakeholders, including workshops in regions of the state that have the most significant exposure to air pollutants;

10. The *Proposed Climate Change Scoping Plan* meets all of the requirements of AB 32.

WHEREAS, pursuant to the requirements of the California Environmental Quality Act and the Board's regulations under its certified regulatory program, the Board further finds that:

11. ARB staff prepared a functional equivalent environmental document for the *Proposed Climate Change Scoping Plan* which indicates that there may be potential adverse environmental impacts from the measures included in the Plan; however, these impacts are speculative and cannot be quantified or further described until the details of the measures are developed and set forth in actual proposed regulations;

12. The Board has considered alternatives to the measures identified in the *Proposed Climate Change Scoping Plan* and has identified no feasible alternatives at this time which would reduce or eliminate any potential adverse environmental impacts, while at the same time ensuring that necessary reductions in greenhouse gas emissions will be achieved;

13. At this time there are no feasible mitigation measures that ARB can impose to lessen the potential adverse impacts of the *Proposed Climate Change Scoping Plan* on the environment, and no less stringent alternatives that will accomplish the goals imposed by AB 32 with fewer potential environmental impacts;

14. None of modifications to the *Proposed Climate Change Scoping Plan* alter any of the conclusions reached in the functional equivalent environmental

document, or would require recirculation of the document as provided in CEQA Guidelines section 15088.5;

15. The potential adverse environmental impacts of the measures included in the *Proposed Climate Change Scoping Plan* are outweighed by the substantial reduction in greenhouse gas emissions and public health benefits that will result from their adoption and implementation;

16. The considerations identified above override any adverse environmental impacts that may occur from adoption and implementation of the *Proposed Climate Change Scoping Plan*;

17. As regulations implementing the *Proposed Climate Change Scoping Plan* are developed, detailed environmental impact analyses, including a discussion of regulatory alternatives and mitigation measures, will be performed as part of the rulemaking process;

18. As regulations implementing the *Proposed Climate Change Scoping Plan* are developed, specific economic impact analyses will be performed in conjunction with the rulemaking process and will be considered by the Board in acting on those regulations;

19. In accordance with Public Resources Code 21081(a)(2), for Scoping Plan measures that are within the responsibility and jurisdiction of another public agency, that agency shall be responsible for completing the appropriate environmental review and, with respect to each significant effect identified in the environmental review, shall be responsible for adopting feasible changes or alterations to the measures to mitigate or avoid, as appropriate, the significant environmental effects that have been identified. An initial list of agencies responsible for Plan measures is included in Appendix C of the Plan.

20. ARB regulations which have been adopted and are included in the measures recommended in the *Proposed Climate Change Scoping Plan* were subjected to environmental review by the Board at the time of their adoption and no further analysis is required at this time; and

21. The Executive Officer is the decision maker for the purposes of responding to environmental issues raised on the *Proposed Climate Change Scoping Plan,* and by approving this Resolution 08-47 the Board is not prejudging any of the responses that will be made by the Executive Officer to these environmental issues.

NOW, THEREFORE, BE IT RESOLVED, that subject to the Executive Officer's approval of written responses to environmental issues that have been raised, the Board is initiating steps toward the final approval of the *Proposed Climate Change Scoping*

Plan and its Appendices, as set forth in Attachments A and B hereto, with the modifications identified at the December 11, 2008 public hearing.

BE IT FURTHER RESOLVED that the Executive Officer is the decision maker for the purposes of title 17, California Code of Regulations, section 60007; the Board directs the Executive Officer to prepare and approve written responses to all significant environmental issues that have been raised, and then to either: (1) return the *Proposed Climate Change Scoping Plan* to the Board for further consideration if it is determined that such action is warranted, or (2) take final action to approve the *Proposed Climate Change Scoping Plan* with the modifications identified at the December 11, 2008 public hearing, any conforming modifications that may be appropriate, and any modifications that are necessary to ensure that all feasible measures or feasible alternatives that would substantially reduce any significant adverse environmental impacts have been incorporated into the final action.

BE IT FURTHER RESOLVED that once final action has been taken by the Executive Officer to approve the *Climate Change Scoping Plan*, as agreed to and modified by the Board, the Board directs the Executive Officer to make the modified Plan available to the public.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to perform the environmental analyses required by CEQA in conjunction with future rulemaking actions to implement the *Climate Change Scoping Plan*, and to ensure that the potential environmental impacts identified in the Plan, and any other impacts are subsequently identified, are avoided or mitigated to the extent feasible.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to ensure that the requirements of Health and Safety Code section 38562(b) are met for all proposed regulations to implement the *Climate Change Scoping Plan*, and that the requirements of Health and Safety Code section 38570(b) are met for all proposed regulations to implement market-based compliance mechanisms.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to design greenhouse gas regulations that affect stationary sources so that they utilize, to the extent practicable and appropriate, local air district permitting programs and compliance determination mechanisms.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to provide funding to the local air districts using State funding mechanisms to reimburse districts for involvement in specific, identified activities related to implementation and enforcement of greenhouse gas emission reduction measures.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a joint workplan with the local air districts to define how to efficiently and effectively implement and administer the Scoping Plan.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a program to provide GHG emissions verifier training without cost to District staff who meet required education and experience qualifications.

BE IT FURTHER RESOLVED that the Board recognizes that emission sources subject to ARB's mandatory reporting regulation must report directly to the State and directs the Executive Officer to develop a software tool that will allow the export of data to the districts.

BE IT FURTHER RESOLVED that the Board recognizes that consistent implementation and enforcement of greenhouse gas emission reduction programs is crucial to minimize administrative burdens and that the future cap-and-trade program, including reporting and verification of offsets, should be administered at the state level.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to establish a working group of public health agencies and organizations, including, but not limited to, the Department of Public Health, the Office of Environmental Health Hazard Assessment, and local public health agencies, to review and provide input to the staff on proposed greenhouse gas reduction measures.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to develop a methodology using available information to assess the potential cumulative air pollution impacts of proposed regulations to implement the Scoping Plan.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to identify communities already adversely impacted by air pollution as specified in Health and Safety Code section 38570 (b)(1) before the adoption of a cap-and-trade program.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to design the implementation of AB 32, including the cap-and-trade system, to complement California's criteria and toxic air contaminant programs and be consistent with ARB's environmental justice policies, in furtherance of achieving the statewide greenhouse gas emissions limit.

BE IT FURTHER RESOLVED that the Board recognizes that through the SB 375 (Stats. 2008, Chapter 728) process, local governments and transportation agencies are key partners in ARB's efforts to reduce greenhouse gas emissions, that improved land use and transportation planning is needed to provide Californians with affordable, high quality options for housing and mobility that will result in reduced greenhouse gas emissions, and that the greenhouse gas reductions associated with more sustainable growth will increase over time.

BE IT FURTHER RESOLVED that the Board recognizes that the technical work of the SB 375 Regional Targets Advisory Committee (RTAC) is critical to building a solid foundation for Board consideration of regional targets.

BE IT FURTHER RESOLVED that as input to the SB 375 target setting process, the RTAC should recommend a method to evaluate the full potential for reducing greenhouse gas emissions in each major region of the state, and statewide, using improved land use patterns, indirect source rules, enhanced bike, walk, and transit infrastructure, and pricing policies where applicable (including congestion, toll, and parking pricing). This evaluation should be done for 2020 and 2035, employ the best available data and models, and identify barriers to achieving this full potential.

BE IT FURTHER RESOLVED that it is the Board's intent that the greenhouse gas emission reductions associated with the SB 375 regional targets represent the most ambitious achievable targets. The estimated reductions in the Scoping Plan will be adjusted to reflect the outcome of the Board's decision on SB 375 targets.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to solicit input from experts to advise ARB on its continuing evaluation of the economic effects of implementing AB 32, including identification of additional models or other economic analysis tools that could be used in the ongoing economic analysis. This will include opportunities for interested parties to share their economic modeling results.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to consider the effects of the program on the overall California economy as staff develops the cap-and-trade regulations and to take into account the joint opinion adopted by the PUC and the CEC on October 17, 2008, while recognizing that the joint opinion was developed based on consideration of the electricity and natural gas sectors, and that the recommendations in the opinion may need to be adapted to meet the needs of the California economy as a whole.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to solicit expert input on key questions related to the distribution or auction of allowances and the use of revenue.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer, as part of the cap-and-trade rulemaking, to consider the economic implications of different cap-and-trade program design options, including:

- various scenarios for allowance distribution (percent auction vs. free distribution, method of distribution);
- various scenarios for the use of auction revenue;
- the initial cap level and the rate of decline of the cap over time;
- the potential supply of offsets within and outside California; and

- the economic and co-benefit effects of limits on the use of offsets.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to coordinate the economic analysis of California's AB 32 program with the analysis conducted for the Western Climate Initiative.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to work with California small businesses during the development of Scoping Plan regulations, to consider the size of the business and type of industry in developing the regulations, and to identify financing programs that could help alleviate costs to small businesses.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to work with the CEC, the PUC and other agencies, as appropriate, to ensure that California's energy demands are met, and that the Scoping Plan and AB 32 are implemented in a manner to avoid disproportionate geographic impacts on energy rates.

BE IT FURTHER RESOLVED that the Board is committed to a cap-and-trade program as an important component of California's comprehensive program to achieve greenhouse gas reductions.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to consider the economic and public health impacts of proposed regulations to implement the Scoping Plan, as well as the requirements of section 38562(b) and 38570(b), as appropriate. For sector-specific regulations affecting sources that are also included in the cap-and-trade program, the staff shall also propose findings to identify the reasons that the emission reductions are best achieved using the proposed regulatory approach.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer, by December 31, 2009, to examine and report on:

- estimates of overall costs and savings and the cost-effectiveness of the reductions, including appropriate inclusion of reductions in co-pollutants;
- estimates of the timing of capital investments, annual expenditures to repay those investments, and the resulting cost savings;
- sensitivity of the results to changes in key inputs, including energy price forecasts and estimates of measure costs and savings; and
- impacts on small businesses.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to update the Board on the public health impacts of climate change as well as the impacts of potential measures that may be taken to mitigate climate change.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to report on the status of the Early Action Measures.

BE IT FURTHER RESOLVED that the Board, in coordination with California Environmental Protection Agency and other state agencies, will take responsibility for the tracking of Scoping Plan implementation and the development of accounting systems to promote consistency and avoid double counting of emission reductions, especially across sectors, to ensure achievement of the AB 32 goals.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to report on the status of Scoping Plan implementation to the Board twice a year.

I hereby certify that the above is a true and correct copy of Resolution 08-47, as adopted by the Air Resources Board.

Monica Vejar

Monica Vejar, Clerk of the Board

Climate Change Scoping Plan Appendices

VOLUME I:
SUPPORTING DOCUMENTS AND MEASURE DETAIL

a framework for change

DECEMBER 2008

Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

Arnold Schwarzenegger
Governor

Linda S. Adams
Secretary, California Environmental Protection Agency

Mary D. Nichols
Chairman, Air Resources Board

James N. Goldstene
Executive Officer, Air Resources Board

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Appendix A: AB 32: The Global Warming Solutions Act of 2006

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Assembly Bill No. 32

CHAPTER 488

An act to add Division 25.5 (commencing with Section 38500) to the Health and Safety Code, relating to air pollution.

[Approved by Governor September 27, 2006. Filed with Secretary of State September 27, 2006.]LEGISLATIVE COUNSEL'S DIGEST

AB 32, Nunez. Air pollution: greenhouse gases: California Global Warming Solutions Act of 2006.

Under existing law, the State Air Resources Board (state board), the State Energy Resources Conservation and Development Commission (Energy Commission), and the California Climate Action Registry all have responsibilities with respect to the control of emissions of greenhouse gases, as defined, and the Secretary for Environmental Protection is required to coordinate emission reductions of greenhouse gases and climate change activity in state government.

This bill would require the state board to adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program, as specified. The bill would require the state board to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020, as specified. The bill would require the state board to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions, as specified. The bill would authorize the state board to adopt market-based compliance mechanisms, as defined, meeting specified requirements. The bill would require the state board to monitor compliance with and enforce any rule, regulation, order, emission limitation, emissions reduction measure, or market-based compliance mechanism adopted by the state board, pursuant to specified provisions of existing law. The bill would authorize the state board to adopt a schedule of fees to be paid by regulated sources of greenhouse gas emissions, as specified.

Because the bill would require the state board to establish emissions limits and other requirements, the violation of which would be a crime, this bill would create a state-mandated local program.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

Text of AB 32

The people of the State of California do enact as follows:

SECTION 1. Division 25.5 (commencing with Section 38500) is added to the Health and Safety Code, to read:

Division 25.5. CALIFORNIA GLOBAL WARMING SOLUTIONS ACT OF 2006

PART 1. GENERAL PROVISIONS

CHAPTER 1. TITLE OF DIVISION

38500. This division shall be known, and may be cited, as the California Global Warming Solutions Act of 2006.

CHAPTER 2. FINDINGS AND DECLARATIONS

38501. The Legislature finds and declares all of the following:

(a) Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.

(b) Global warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing, and forestry. It will also increase the strain on electricity supplies necessary to meet the demand for summer air-conditioning in the hottest parts of the state.

(c) California has long been a national and international leader on energy conservation and environmental stewardship efforts, including the areas of air quality protections, energy efficiency requirements, renewable energy standards, natural resource conservation, and greenhouse gas emission standards for passenger vehicles. The program established by this division will continue this tradition of environmental leadership by placing California at the forefront of national and international efforts to reduce emissions of greenhouse gases.

(d) National and international actions are necessary to fully address the issue of global warming. However, action taken by California to reduce emissions of greenhouse gases will have far-reaching effects by encouraging other states, the federal government, and other countries to act.

(e) By exercising a global leadership role, California will also position its economy, technology centers, financial institutions, and businesses to benefit from national and international efforts to reduce emissions of greenhouse gases. More importantly, investing in the development of innovative and pioneering technologies will assist California in achieving the 2020 statewide limit on emissions of greenhouse gases established by this division and will provide an opportunity for the state to take a global economic and technological leadership role in reducing emissions of greenhouse gases.

(f) It is the intent of the Legislature that the State Air Resources Board coordinate with state agencies, as well as consult with the environmental justice community, industry sectors, business groups, academic institutions,

environmental organizations, and other stakeholders in implementing this division.

(g) It is the intent of the Legislature that the State Air Resources Board consult with the Public Utilities Commission in the development of emissions reduction measures, including limits on emissions of greenhouse gases applied to electricity and natural gas providers regulated by the Public Utilities Commission in order to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements.

(h) It is the intent of the Legislature that the State Air Resources Board design emissions reduction measures to meet the statewide emissions limits for greenhouse gases established pursuant to this division in a manner that minimizes costs and maximizes benefits for California's economy, improves and modernizes California's energy infrastructure and maintains electric system reliability, maximizes additional environmental and economic co-benefits for California, and complements the state's efforts to improve air quality.

(i) It is the intent of the Legislature that the Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 continue its role in coordinating overall climate policy.

CHAPTER 3. DEFINITIONS

38505. For the purposes of this division, the following terms have the following meanings:

(a) "Allowance" means an authorization to emit, during a specified year, up to one ton of carbon dioxide equivalent.

(b) "Alternative compliance mechanism" means an action undertaken by a greenhouse gas emission source that achieves the equivalent reduction of greenhouse gas emissions over the same time period as a direct emission reduction, and that is approved by the state board. "Alternative compliance mechanism" includes, but is not limited to, a flexible compliance schedule, alternative control technology, a process change, or a product substitution.

(c) "Carbon dioxide equivalent" means the amount of carbon dioxide by weight that would produce the same global warming impact as a given weight of another greenhouse gas, based on the best available science, including from the Intergovernmental Panel on Climate Change.

(d) "Cost-effective" or "cost-effectiveness" means the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential.

(e) "Direct emission reduction" means a greenhouse gas emission reduction action made by a greenhouse gas emission source at that source.

(f) "Emissions reduction measure" means programs, measures, standards, and alternative compliance mechanisms authorized pursuant to this division, applicable to sources or categories of sources, that are designed to reduce emissions of greenhouse gases.

(g) "Greenhouse gas" or "greenhouse gases" includes all of the following gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexaflouride.

(h) "Greenhouse gas emissions limit" means an authorization, during a specified year, to emit up to a level of greenhouse gases specified by the state board, expressed in tons of carbon dioxide equivalents.

(i) "Greenhouse gas emission source" or "source" means any source, or category of sources, of greenhouse gas emissions whose emissions are at a level of significance, as determined by the state board, that its participation in the program established under this division will enable the state board to effectively reduce greenhouse gas emissions and monitor compliance with the statewide greenhouse gas emissions limit.

(j) "Leakage" means a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state.

(k) "Market-based compliance mechanism" means either of the following:

(1) A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases.

(2) Greenhouse gas emissions exchanges, banking, credits, and other transactions, governed by rules and protocols established by the state board, that result in the same greenhouse gas emission reduction, over the same time period, as direct compliance with a greenhouse gas emission limit or emission reduction measure adopted by the state board pursuant to this division.

(l) "State board" means the State Air Resources Board.

(m) "Statewide greenhouse gas emissions" means the total annual emissions of greenhouse gases in the state, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in California, accounting for transmission and distribution line losses, whether the electricity is generated in state or imported. Statewide emissions shall be expressed in tons of carbon dioxide equivalents.

(n) "Statewide greenhouse gas emissions limit" or "statewide emissions limit" means the maximum allowable level of statewide greenhouse gas emissions in 2020, as determined by the state board pursuant to Part 3 (commencing with Section 38850).

CHAPTER 4. ROLE OF STATE BOARD

38510. The State Air Resources Board is the state agency charged with monitoring and regulating sources of emissions of greenhouse gases that cause global warming in order to reduce emissions of greenhouse gases.

PART 2. MANDATORY GREENHOUSE GAS EMISSIONS REPORTING

38530. (a) On or before January 1, 2008, the state board shall adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program.

(b) The regulations shall do all of the following:

(1) Require the monitoring and annual reporting of greenhouse gas emissions from greenhouse gas emission sources beginning with the sources or categories of sources that contribute the most to statewide emissions.

(2) Account for greenhouse gas emissions from all electricity consumed in the state, including transmission and distribution line losses from electricity generated within the state or imported from outside the state. This requirement applies to all retail sellers of electricity, including load-serving

entities as defined in subdivision (j) of Section 380 of the Public Utilities Code and local publicly owned electric utilities as defined in Section 9604 of the Public Utilities Code.

(3) Where appropriate and to the maximum extent feasible, incorporate the standards and protocols developed by the California Climate Action Registry, established pursuant to Chapter 6 (commencing with Section 42800) of Part 4 of Division 26. Entities that voluntarily participated in the California Climate Action Registry prior to December 31, 2006, and have developed a greenhouse gas emission reporting program, shall not be required to significantly alter their reporting or verification program except as necessary to ensure that reporting is complete and verifiable for the purposes of compliance with this division as determined by the state board.

(4) Ensure rigorous and consistent accounting of emissions, and provide reporting tools and formats to ensure collection of necessary data.

(5) Ensure that greenhouse gas emission sources maintain comprehensive records of all reported greenhouse gas emissions.

(c) The state board shall do both of the following:

(1) Periodically review and update its emission reporting requirements, as necessary.

(2) Review existing and proposed international, federal, and state greenhouse gas emission reporting programs and make reasonable efforts to promote consistency among the programs established pursuant to this part and other programs, and to streamline reporting requirements on greenhouse gas emission sources.

PART 3. STATEWIDE GREENHOUSE GAS EMISSIONS LIMIT

38550. By January 1, 2008, the state board shall, after one or more public workshops, with public notice, and an opportunity for all interested parties to comment, determine what the statewide greenhouse gas emissions level was in 1990, and approve in a public hearing, a statewide greenhouse gas emissions limit that is equivalent to that level, to be achieved by 2020. In order to ensure the most accurate determination feasible, the state board shall evaluate the best available scientific, technological, and economic information on greenhouse gas emissions to determine the 1990 level of greenhouse gas emissions.

38551. (a) The statewide greenhouse gas emissions limit shall remain in effect unless otherwise amended or repealed.

(b) It is the intent of the Legislature that the statewide greenhouse gas emissions limit continue in existence and be used to maintain and continue reductions in emissions of greenhouse gases beyond 2020

(c) The state board shall make recommendations to the Governor and the Legislature on how to continue reductions of greenhouse gas emissions beyond 2020.

PART 4. GREENHOUSE GAS EMISSIONS REDUCTIONS

38560. The state board shall adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions from sources or categories of sources, subject to the criteria and schedules set forth in this part.

38560.5. (a) On or before June 30, 2007, the state board shall publish and make available to the public a list of discrete early action greenhouse gas emission reduction measures that can be implemented prior to the measures and limits adopted pursuant to Section 38562.

(b) On or before January 1, 2010, the state board shall adopt regulations to implement the measures identified on the list published pursuant to subdivision (a).

(c) The regulations adopted by the state board pursuant to this section shall achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from those sources or categories of sources, in furtherance of achieving the statewide greenhouse gas emissions limit.

(d) The regulations adopted pursuant to this section shall be enforceable no later than January 1, 2010.

38561. (a) On or before January 1, 2009, the state board shall prepare and approve a scoping plan, as that term is understood by the state board, for achieving the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from sources or categories of sources of greenhouse gases by 2020 under this division. The state board shall consult with all state agencies with jurisdiction over sources of greenhouse gases, including the Public Utilities Commission and the State Energy Resources Conservation and Development Commission, on all elements of its plan that pertain to energy related matters including, but not limited to, electrical generation, load based-standards or requirements, the provision of reliable and affordable electrical service, petroleum refining, and statewide fuel supplies to ensure the greenhouse gas emissions reduction activities to be adopted and implemented by the state board are complementary, nonduplicative, and can be implemented in an efficient and cost-effective manner.

(b) The plan shall identify and make recommendations on direct emission reduction measures, alternative compliance mechanisms, market-based compliance mechanisms, and potential monetary and nonmonetary incentives for sources and categories of sources that the state board finds are necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of greenhouse gas emissions by 2020.

(c) In making the determinations required by subdivision (b), the state board shall consider all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada, and the European Union.

(d) The state board shall evaluate the total potential costs and total potential economic and noneconomic benefits of the plan for reducing greenhouse gases to California's economy, environment, and public health, using the best available economic models, emission estimation techniques, and other scientific methods.

(e) In developing its plan, the state board shall take into account the relative contribution of each source or source category to statewide greenhouse gas emissions, and the potential for adverse effects on small businesses, and shall recommend a de minimis threshold of greenhouse gas emissions below which emission reduction requirements will not apply.

(f) In developing its plan, the state board shall identify opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, including, but not limited to, carbon sequestration projects and best management practices.

(g) The state board shall conduct a series of public workshops to give interested parties an opportunity to comment on the plan. The state board shall conduct a portion of these workshops in regions of the state that have the most significant exposure to air pollutants, including, but not limited to, communities with minority populations, communities with low-income populations, or both.

(h) The state board shall update its plan for achieving the maximum technologically feasible and cost-effective reductions of greenhouse gas emissions at least once every five years.

38562. (a) On or before January 1, 2011, the state board shall adopt greenhouse gas emission limits and emission reduction measures by regulation to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions in furtherance of achieving the statewide greenhouse gas emissions limit, to become operative beginning on January 1, 2012.

(b) In adopting regulations pursuant to this section and Part 5 (commencing with Section 38570), to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, the state board shall do all of the following:

(1) Design the regulations, including distribution of emissions allowances where appropriate, in a manner that is equitable, seeks to minimize costs and maximize the total benefits to California, and encourages early action to reduce greenhouse gas emissions.

(2) Ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities.

(3) Ensure that entities that have voluntarily reduced their greenhouse gas emissions prior to the implementation of this section receive appropriate credit for early voluntary reductions.

(4) Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions.

(5) Consider cost-effectiveness of these regulations.

(6) Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health.

(7) Minimize the administrative burden of implementing and complying with these regulations.

(8) Minimize leakage.

(9) Consider the significance of the contribution of each source or category of sources to statewide emissions of greenhouse gases.

(c) In furtherance of achieving the statewide greenhouse gas emissions limit, by January 1, 2011, the state board may adopt a regulation that establishes a system of market-based declining annual aggregate emission limits for sources or categories of sources that emit greenhouse gas emissions, applicable from January 1, 2012, to December 31, 2020, inclusive, that the state board determines will achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions, in the aggregate, from those sources or categories of sources.

(d) Any regulation adopted by the state board pursuant to this part or Part 5 (commencing with Section 38570) shall ensure all of the following:

(1) The greenhouse gas emission reductions achieved are real, permanent, quantifiable, verifiable, and enforceable by the state board.

(2) For regulations pursuant to Part 5 (commencing with Section 38570), the reduction is in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur.

(3) If applicable, the greenhouse gas emission reduction occurs over the same time period and is equivalent in amount to any direct emission reduction required pursuant to this division.

(e) The state board shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required by this section.

(f) The state board shall consult with the Public Utilities Commission in the development of the regulations as they affect electricity and natural gas providers in order to minimize duplicative or inconsistent regulatory requirements.

(g) After January 1, 2011, the state board may revise regulations adopted pursuant to this section and adopt additional regulations to further the provisions of this division.

38563. Nothing in this division restricts the state board from adopting greenhouse gas emission limits or emission reduction measures prior to January 1, 2011, imposing those limits or measures prior to January 1, 2012, or providing early reduction credit where appropriate.

38564. The state board shall consult with other states, and the federal government, and other nations to identify the most effective strategies and methods to reduce greenhouse gases, manage greenhouse gas control programs, and to facilitate the development of integrated and cost-effective regional, national, and international greenhouse gas reduction programs.

38565. The state board shall ensure that the greenhouse gas emission reduction rules, regulations, programs, mechanisms, and incentives under its jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California and provide an opportunity for small businesses, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions.

PART 5. MARKET-BASED COMPLIANCE MECHANISMS

38570. (a) The state board may include in the regulations adopted pursuant to Section 38562 the use of market-based compliance mechanisms to comply with the regulations.

(b) Prior to the inclusion of any market-based compliance mechanism in the regulations, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, the state board shall do all of the following:

(1) Consider the potential for direct, indirect, and cumulative emission impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution.

(2) Design any market-based compliance mechanism to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants.

(3) Maximize additional environmental and economic benefits for California, as appropriate.

(c) The state board shall adopt regulations governing how market-based compliance mechanisms may be used by regulated entities subject to greenhouse gas emission limits and mandatory emission reporting requirements to achieve compliance with their greenhouse gas emissions limits.

38571. The state board shall adopt methodologies for the quantification of voluntary greenhouse gas emission reductions. The state board shall adopt regulations to verify and enforce any voluntary greenhouse gas emission reductions that are authorized by the state board for use to comply with greenhouse gas emission limits established by the state board. The adoption of methodologies is exempt from the rulemaking provisions of the Administrative Procedure Act (Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code).

38574. Nothing in this part or Part 4 (commencing with Section 38560) confers any authority on the state board to alter any programs administered by other state agencies for the reduction of greenhouse gas emissions.

PART 6. ENFORCEMENT

38580. (a) The state board shall monitor compliance with and enforce any rule, regulation, order, emission limitation, emissions reduction measure, or market-based compliance mechanism adopted by the state board pursuant to this division.

(b) (1) Any violation of any rule, regulation, order, emission limitation, emissions reduction measure, or other measure adopted by the state board pursuant to this division may be enjoined pursuant to Section 41513, and the violation is subject to those penalties set forth in Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(2) Any violation of any rule, regulation, order, emission limitation, emissions reduction measure, or other measure adopted by the state board pursuant to this division shall be deemed to result in an emission of an air contaminant for the purposes of the penalty provisions of Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(3) The state board may develop a method to convert a violation of any rule, regulation, order, emission limitation, or other emissions reduction measure adopted by the state board pursuant to this division into the number of days in violation, where appropriate, for the purposes of the penalty provisions of Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(c) Section 42407 and subdivision (i) of Section 42410 shall not apply to this part.

PART 7. MISCELLANEOUS PROVISIONS

38590. If the regulations adopted pursuant to Section 43018.5 do not remain in effect, the state board shall implement alternative regulations to control mobile sources of greenhouse gas emissions to achieve equivalent or greater reductions.

38591. (a) The state board, by July 1, 2007, shall convene an environmental justice advisory committee, of at least three members, to advise it in developing the scoping plan pursuant to Section 38561 and any other pertinent matter in implementing this division. The advisory committee shall be comprised of representatives from communities in the state with the most significant exposure to air pollution, including, but not limited to, communities with minority populations or low-income populations, or both.

(b) The state board shall appoint the advisory committee members from nominations received from environmental justice organizations and community groups.

(c) The state board shall provide reasonable per diem for attendance at advisory committee meetings by advisory committee members from nonprofit organizations.

(d) The state board shall appoint an Economic and Technology Advancement Advisory Committee to advise the state board on activities that will facilitate investment in and implementation of technological research and development opportunities, including, but not limited to, identifying new technologies, research, demonstration projects, funding opportunities, developing state, national, and international partnerships and technology transfer opportunities, and identifying and assessing research and advanced technology investment and incentive opportunities that will assist in the reduction of greenhouse gas emissions. The committee may also advise the state board on state, regional, national, and international economic and technological developments related to greenhouse gas emission reductions.

38592. (a) All state agencies shall consider and implement strategies to reduce their greenhouse gas emissions.

(b) Nothing in this division shall relieve any person, entity, or public agency of compliance with other applicable federal, state, or local laws or

regulations, including state air and water quality requirements, and other requirements for protecting public health or the environment.

38593. (a) Nothing in this division affects the authority of the Public Utilities Commission.(b) Nothing in this division affects the obligation of an electrical corporation to provide customers with safe and reliable electric service.

38594. Nothing in this division shall limit or expand the existing authority of any district, as defined in Section 39025.

38595. Nothing in this division shall preclude, prohibit, or restrict the construction of any new facility or the expansion of an existing facility subject to regulation under this division, if all applicable requirements are met and the facility is in compliance with regulations adopted pursuant to this division.

38596. The provisions of this division are severable. If any provision of this division or its application is held invalid, that invalidity shall not affect other provisions or applications that can be given effect without the invalid provision or application.

38597. The state board may adopt by regulation, after a public workshop, a schedule of fees to be paid by the sources of greenhouse gas emissions regulated pursuant to this division, consistent with Section 57001. The revenues collected pursuant to this section, shall be deposited into the Air Pollution Control Fund and are available upon appropriation, by the Legislature, for purposes of carrying out this division.

38598. (a) Nothing in this division shall limit the existing authority of a state entity to adopt and implement greenhouse gas emissions reduction measures.

(b) Nothing in this division shall relieve any state entity of its legal obligations to comply with existing law or regulation.

38599. (a) In the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm, the Governor may adjust the applicable deadlines for individual regulations, or for the state in the aggregate, to the earliest feasible date after that deadline.

(b) The adjustment period may not exceed one year unless the Governor makes an additional adjustment pursuant to subdivision (a).

(c) Nothing in this section affects the powers and duties established in the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code).

(d) The Governor shall, within 10 days of invoking subdivision (a), provide written notification to the Legislature of the action undertaken.

SEC. 2 No reimbursement is required by this act pursuant to Section 6 of Article XIIIB of the California Constitution because the only costs that may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, eliminates a crime or infraction, or changes the penalty for a crime or infraction, within the meaning of Section 17556 of the Government Code, or changes the definition of a crime within the meaning of Section 6 of Article XIIIB of the California Constitution.

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Appendix B: List of Acronyms and Glossary

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ACRONYMS

AB	Assembly Bill
A/C	Air Conditioning
ADC	Alternative Daily Cover
AF	Acre Foot
Ag	Agriculture
APCD	Air Pollution Control District
AQMD	Air Quality Management District
ARB	Air Resources Board
ARMINES	School of Mining Engineering of Paris
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATCM	Airborne Toxic Control Measure
BACT	Best Available Control Technology
BAR	(California) Bureau of Automotive Repair
BAU	Business as Usual
BBEEs	Big Bold Energy Efficiency Strategies
BC	British Columbia (Canada)
BEAR	Berkeley Energy and Resources
BG	Billion Gallons
BIPV	Building Integrated Photovoltaic
BMP	Best Management Practices
BNSF	Burlington Northern Santa Fe
BOD	Biological Oxygen Demand
BOF	(California) Board of Forestry and Fire Protection
BSFC	Brake Specific Fuel Consumption Value
BTUs	British Thermal Units
CAFO	Confined Animal Feeding Operation
CAISO	California Independent System Operator
CalEPA	California Environmental Protection Agency
CalTrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CAT	Climate Action Team
CBSC	California Building Standards Commission
CCA	Community Choice Aggregators
CCAR	California Climate Action Registry

CCGT	Combined Cycle Gas Turbine
CCRC	Climate Change Research Center
CCS	Carbon Dioxide Capture and Sequestration
C&D	Construction and Demolition
CDE	California Department of Education
CDFA	California Department of Food and Agriculture
CD-ROM	Compact Disc Read-Only Memory
C-E	Cost Effectiveness
CEC	California Energy Commission
CEFS	California Emission Forecast System
CEIDARS	California Emission Inventory Development and Reporting System
CEQA	California Environmental Quality Act
C_2F_6	Hexafluoroethane
CFC	Chlorofluorocarbons
CFIP	California Forest Improvement Program
CFL	Compact Fluorescent Lighting
CFR	Code of Federal Regulations
CGBSC	California Green Building Standards Code
CH_4	Methane
CHP	Combined Heat and Power
CHPS	Collaborative for High Performance Schools
CICS	California Institute for Climate Solutions
CIF	Carbon Intensity Factor
CIWMB	California Integrated Waste Management Board
CMUA	California Municipal Utilities Association
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2E	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
CR	Commercial and Residential (Energy Use)
CRC	Carbon Regenerated Catalyst
CREB	Clean Renewable Energy Bonds
CRF	Capital Recovery Factor
CSA	Consumer Service Agent
CSAC	California State Association of Counties
CSI	California Solar Initiative
CSU	California State University

CTE	Career and Technical Education
CVD	Chemical Vapor Deposition
CY	Calendar Year
DCA	(California) Department of Consumer Affairs
DFG	(California) Department of Fish and Game
DPH	(California) Department of Public Health
DG	Distributed Generation
DGS	(California) Department of General Services
DIY	Do-it-yourself
DMV	(California) Department of Motor Vehicles
DOC	(California) Department of Conservation
DOE	(California) Department of Energy
DOF	(California) Department of Forestry and Fire Protection
DOT	(California) Department of Transportation
DWR	(California) Department of Water Resources
DX	Direct Expansion
E-85	Ethanol
EAP	Energy Action Plan
EB	Existing Buildings
EBI	Energy Biosciences Institute
E-DRAM	Environmental Dynamic Revenue Assessment Model
EE	Energy Efficiency
EF	Efficiency Factor
EIA	Energy Information Administration
EJ	Environmental Justice
EJAC	Environmental Justice Advisory Committee
EMFAC	Emission Factors Model
EMS	Environmental Management System
EO	Executive Order
EOL	End-of-life
EPAct	Energy Policy Act
EPEAT	Electronic Product Environmental Assessment Tool
EPP	Environmentally Preferable Purchasing
EPR	Extended Producer Responsibility
EPRI	Electric Power Research Institute
EPEAT	Electronic Product Environmental Assessment Tool
EPS	Emissions Performance Standard
ESCO	Energy Services Companies

ESP	Economic Strategy Panel
ESPs	Electric Service Providers
ETAAC	Economic and Technology Advancement Advisory Committee
ETP	Employment Training Panel
EU	European Union
FAMS	Fleet Assessment Management System
FCC	Fluidized Catalytic Cracking
FED	Functionally Equivalent Document
FHWA	Federal Highway Administration
FJD	First Jurisdictional Deliverer
FRAP	Fire and Resources Assessment Program
GB	Green Building
GBI	Green Building Initiative
GBSC	Green Building Standards Commission
gCO_2E/MJ	Grams of CO_2 Equivalent per Mega-Joule
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Gas-Insulated Substations
GMERP	Goods Movement Emission Reduction Plan
GPS	Global Positioning System
GSA	General Services Administration
GSP	Gross State Product
GVW	Gross Vehicle Weight
GVWR	Gross Vehicle Weight Rating
GWh	Gigawatt Hours
GWP	Global Warming Potential
HCCI	Homogenous Charge Compression Ignition
HCD	(California Department of) Housing and Community Development
HCFC	Hydrochlorofluorocarbons
HERS	Home Energy Rating System
HFC	Hydrofluorocarbons
HFE	Hydrofluoroethers
HHDD	Heavy Heavy-Duty Diesels
HSC	Health and Safety Code
HSR	High Speed Rail
HVAC	Heating, Ventilation, and Air Conditioning
I.C.	Internal Combustion
ICAP	International Carbon Action Partnership

ICE	Internal Combustion Engine
ICLEI	International Council for Local Environmental Initiatives
ICTF	Intermodal Container Transfer Facility
IEPR	Integrated Energy Policy Report
IGEM	Institution of Gas Engineers and Managers
IID	Imperial Irrigation District
ILG	Institute for Local Governments
I/M	Inspection and Maintenance (Smog Check)
IOU	Investor Owned Utilities
IPCC	Intergovernmental Panel on Climate Change
ISO	Independent Systems Operation
ISR	Indirect Source Rule(s)
IT	Information Technology
IWMP	Integrated Waste Management Plan
$kgCO_2E$	Kilograms of Carbon Dioxide Equivalent
kw	Kilowatt
kWh	Kilowatt Hours
kWh/y	Kilowatt Hours per Year
LADWP	Los Angeles Department of Water and Power
LAFCO	Local Agency Formation Commission
Lb/yd^3	Pound per Cubic Yard
LCCP	Lifecycle Climate Performance
LCD	Liquid Crystal Display
LCFS	Low Carbon Fuel Standard
LDAR	Leak Detection and Repair
LDCs	Local Distribution Companies
LDT	Light-Duty Truck
LDV	Light-Duty Vehicle
LEA	Local Solid Waste Enforcement Agencies
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
LEED- EB	Leadership in Energy and Environmental Design for Existing Buildings
LEED- NC	Leadership in Energy and Environmental Design for New Commercial Buildings
LEV	Low-Emission Vehicle
LID	Low Impact Development
LIEE	Low Income Energy Efficiency
LIOB	Low-Income Oversight Board

LMID	Labor Market Information Division
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LSE	Load Serving Entities
LSI	Large-Spark Ignition
LUSCAT	Land Use Subgroup of the Climate Action Team
LWDA	Labor and Workforce Development Agency
MAC	Market Advisory Committee
MAF	Million Acre Feet
MAP	Million Annual Passengers
MG	Million Gallons
MHDD	Medium Heavy-Duty Diesels
MIT	Massachusetts Institute of Technology
MMBtu	Million Metric British Thermal Units
$MMTCO_2$	Million Metric Tons of Carbon Dioxide
$MMTCO_2E$	Million Metric Tons of Carbon Dioxide Equivalents
MOU	Memorandum of Understanding
MPG	Miles per gallon
MPO	Metropolitan Planning Organization
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MT	Metric Tons
$MTCO_2E$	Metric Ton of CO_2 Equivalent
MVAC	Motor Vehicle Air Conditioning System
MW	Megawatt
MWh	Megawatt Hour
MWH/AF	Megawatt Hours per Acre-foot
MY	Model Year
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standard
NC	New Construction
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollution
NF_3	Nitrogen Trifluoride
NGO	Non-Governmental Organization
NH_3	Ammonia
nm	Nautical Miles
N_2O	Nitrous Oxide

NO_x	Oxides of Nitrogen, Nitrogen Dioxide
NPV	Net Present Value
NRC	National Research Council
NSHP	New Solar Homes Partnership
ODS	Ozone-Depleting Substances
OEMs	Original Equipment Manufacturers
O&G	Oil and Gas
OPR	(Governor's) Office of Planning and Research
OPSC	Office of Public School Construction
PAYD	Pay-As-You-Drive
PC	Passenger Cars
PERS	(California) Public Employees Retirement System
PFC	Perfluorocarbon
PFPE	Perfluoropolyethers
PG&E	Pacific Gas and Electric
PIER	Public Interest Energy Research
PM	Particulate Matter
PM2.5	Particulate Matter less than 2.5 microns
POU	Publicly Owned Utilities
PPM	Parts Per Million
PRC	Public Resources Code
PSP	Proposed Scoping Plan
PUC	Public Utilities Commission
PV	Photovoltaic
RA	Resources Agency
RAC	Refrigeration and Air Conditioning
RAD	Responsible Appliance Disposal
RCx	Retro-commissioning
R&D	Research and Development
RD&D	Research, Development, and Demonstration
REAP	Rural Energy for America Program
RECs	Renewable Energy Credits
RECLAIM	Regional Clean Air Incentive Market
REDD	Reducing Emissions from Deforestation and Forest Degradation
RETI	Renewable Energy Transmission Initiative
RFS	Renewable Fuels Standard
RGGI	Regional Greenhouse Gas Initiative
RIN	Renewable Identification Number

RFS	Renewable Fuel Standard
ROG	Reactive Organic Gas
RPS	Renewables Portfolio Standard
RS	Renewables Standard
RTP	Regional Transportation Plan
R&WM	Recycling and Waste Management
SAB	State Allocation Board
SACOG	Sacramento Area Council of Governments
SAFETEA-LU	Safe, Accountable, Flexible Transportation Equity Act-Legacy for Users
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCIG	Southern California International Gateway
SCM	Supplementary Cementitious Material
SDG&E	San Diego Gas and Electric
SF_6	Sulfur Hexaflouride
SFP	School Facility Programs
SGIP	Self Generation Incentive Program
SHWEA	Solar Hot Water Efficiency Act
SIA	Semiconductor Industry Association
SIP	State Implementation Plan
SJVAPCD	San Joaquin Valley Air Pollution Control District
SL	Secondary Loop
SMUD	Sacramento Municipal Utility District
SOx	Sulfur Oxide
SO_2	Sulfur Dioxide
SSI	Systematic Solutions, Inc.
STAR	Science to Achieve Results
STIP	State Transportation Improvement Program
STRS	(California) State Teachers Retirement System
SUV	Sports Utility Vehicle
SWH	Solar Water Heating
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAA	Trade Adjustment Assistance
TAC	Toxic Air Contaminant
TBD	To Be Determined

TCR	The Climate Registry
T&D	Transmission and Distribution
TEAP	Technology and Economic Assessment Panel
TEWI	Total Equivalent Warming Impact
TLC	Timberland Conversion
TPD	Tons Per Day
TRU	Transport Refrigeration Units
TWh	Terawatt Hours
UC	University of California
UP	Union Pacific Railroad
USDA	United States Department of Agriculture
USDOE	United State Department of Energy
U.S. EPA	United States Environmental Protection Agency
UTO	Useful Thermal Output
VFD	Variable Frequency Drive
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
VSR	Vessel Speed Reduction
WCI	Western Climate Initiative
WDR	Waste Discharge Requirement
WECC	Western Electricity Coordinating Council
WESTCARB	West Coast Regional Carbon Sequestration Partnership
ZEH/C	Zero Energy Heating and/or Cooling
ZEV	Zero Emission Vehicle
ZNE	Zero Net Energy

GLOSSARY OF CLIMATE CHANGE TERMS

Afforestation: Planting of new forests on lands that historically have not contained forests.

Allocation: Process by which emission allowances are periodically distributed both initially and on an on-going basis under an emissions cap and trade system.

Allowance: An authorization to emit, during a specified year, up to one ton of carbon dioxide equivalent. (HSC §38505(a))

Berkeley Energy and Resource (BEAR) Model: A dynamic general equilibrium forecasting model that simulates the way that changes in energy investment, price and use affect how Californians live their lives.

Cap: A limit on emissions.

Cap and Trade: An environmental regulatory program that limits (caps) the total emissions of a certain pollutant by issuing tradable allowances and requiring that allowances be surrendered to cover actual emissions. The limit on the number of tradable allowances issued ensures that emissions will not exceed the desired amount.

Carbon Dioxide Equivalent (CO_2E): A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential. Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents ($MMTCO_2E$)".

Carbon Intensity: Intensity of an energy supply, defined as the amount of carbon emitted per unit of energy.

California Climate Action Registry (CCAR): A private non-profit organization originally formed by the State of California. The California Registry serves as a voluntary greenhouse gas (GHG) registry to protect and promote early actions to reduce GHG emissions by organizations.

Cost-Effectiveness: The cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential. (HSC §38505(d))

Criteria Pollutants: U.S. EPA has identified six "criteria pollutants," ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead as indicators of air quality, and for each is an established maximum concentration above which adverse effects on human health may occur.

Discrete Early Action: Greenhouse gas reduction measures enforceable by January 1, 2010. (HSC §38560.5)

Early Action: Greenhouse gas reduction measures to be initiated by ARB in the 2007-2012 timeframe. These measures may be regulatory or non-regulatory.

Environmental Dynamic Revenue Assessment Model (E-DRAM): A dynamic general equilibrium forecasting model that simulates the way that changes in energy investment, price and use affect how Californians live their lives.

Energy 2020: An economy-wide energy use model that predicts the investment behavior of both energy suppliers and consumers.

Economic and Technology Advancement Advisory Committee (ETAAC): A committee which advises ARB on activities that will facilitate investment in and implementation of technological research and development opportunities including, but not limited to, identifying new technologies, research, demonstration projects, funding opportunities, developing state, national, and international partnerships and technology transfer opportunities, and identifying and assessing research and advanced technology investment and incentive opportunities that will assist in the reduction of greenhouse gas emissions. (HSC §38591(d))

Environmental Justice Advisory Committee (EJAC): A committee created by AB 32 whose mission is to advise ARB in developing the Scoping Plan and any other pertinent matter in implementing AB 32. (HSC §38591(a))

Global Warming Potential (GWP): The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from emission of one kilogram of carbon dioxide over a period of time (usually 100 years).

Greenhouse Gas (GHG): Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and hydrofluorocarbons (HFCs). (HSC §38505(g))

Intergovernmental Panel on Climate Change (IPCC): Established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988 for the purpose of assessing information in the scientific and technical literature related to all significant components of the issue of climate change.

Investor Owned Utilities (IOUs): A private company that provides a utility, such as water, natural gas or electricity, to a specific service area.

Kyoto Gases: Carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH4), sulfur hexafluoride (SF6), hydrofluorocarbons, and perfluorocarbons.

Leakage: A reduction in emissions of greenhouse gases within California that is offset by an increase in emissions of greenhouse gases outside the state. (HSC §38505(j))

Montreal Gases: Ozone depleting substances covered by the Montreal Protocol, including chlorofluorocarbons, hydrochlorofluorocarbons, carbon tetrachloride, methyl chloroform, and brominated gases.

Offsets: Verifiable emission reductions whose ownership can be transferred to others.

Ozone Depleting Substance (ODS): A compound that contributes to stratospheric ozone depletion. These substances include chlorofluorocarbons, hydrochlorofluorocarbons, halons, methyl bromide, carbon tetrachloride, and methyl chloroform.

Public Owned Utilities (POUs): Non-profit utility providers owned by a community and operated by municipalities, counties, states, public power districts, or other public organizations.

Reforestation: Planting of forests on lands that have previously contained forests but that have been converted to some other use.

Sequestration: The process of increasing the carbon content of a carbon reservoir other than the atmosphere. Biological approaches to sequestration include direct removal of carbon dioxide from the atmosphere through land-use change, afforestation, reforestation, and practices that enhance soil carbon in agriculture. Physical approaches include separation and disposal of carbon dioxide from flue gases or from processing fossil fuels to produce hydrogen- and carbon dioxide-rich fractions and long-term storage in underground in depleted oil and gas reservoirs, coal seams, and saline aquifers.

Set-Aside: An allowance set-aside is a pool of allowances which are distributed using criteria alternative to the primary method of allocation. Allowance set-asides direct a certain portion of allowances from within the cap to recognize actions previously taken or further incentivize future actions which benefit the policy goal

Voluntary Measures: Measures to reduce GHG emissions that are adopted in the absence of government mandates.

Western Electricity Coordinating Council (WECC): A regional forum for promoting regional electric service reliability in Western Canada and the Western United States.

Appendix C: Sector Overviews and Emission Reduction Strategies

INTRODUCTION

This appendix describes each of the economic sectors and individual measures outlined in the Scoping Plan. The measure descriptions include estimated emission reductions and the associated estimated net cost of the measure, the lead agencies associated with each measure, and the timeframe for adoption and implementation of the measure. Please note that there are additional greenhouse gas emission reduction strategies included in this Appendix, that are not listed in, or counted upon, in the Scoping Plan. These additional strategies could provide additional GHG emission reductions to fill potential shortfalls in emission reductions as discussed in the *Tracking and Measuring Progress* section of the Scoping Plan.

The measures identified in this Appendix were developed by ARB with input from state agencies, sector specific Climate Action Teams subgroups (Sub-CATs) and the public. Many of these measures are in developmental stages and the estimated costs, emission reductions, applicable technologies, and other factors will likely change as they move through the regulatory process.

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1. CAP AND TRADE

This section includes the following measures:

<u>Recommended Actions</u>
California Cap-and-Trade Program Linked to Western Climate Initiative

Background

A cap-and-trade program can help meet the requirements of AB 32 by providing cost-effective GHG reductions. The cap establishes a limit on emissions that declines over time. The ability to trade gives regulated sources greater incentive to pursue low-cost emission reduction strategies at their facilities than a source by source program would. Like all regulatory programs, an effective cap-and-trade system must be well designed, and include strong monitoring, reporting and enforcement rules, including strict penalties for non-compliance. In addition, AB 32 includes specific criteria that ARB must consider before adopting regulations for market-based measures, and directs the Board to the extent feasible to design any market-based compliance mechanisms to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants. (HSC §38570(b))

A well-designed cap-and-trade system provides certainty that the program will meet the emissions limit while creating a price for GHG emissions that reflects the cost of the reductions needed to meet the environmental goal. This price signal affects decisions by both producers and consumers about the energy and services that they provide or use. Facilities have a continuous incentive to reduce emissions in order to reduce their compliance costs. The market creates an opportunity for facilities that can reduce emissions at lower cost to do so. One example of a cap-and-trade program is the U.S. EPA's acid rain trading program, a national program to decrease acid rain by reducing emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from power plants. The acid rain program has successfully achieved the environmental goal of the cap at a cost of several billion dollars less than originally expected.[1]

California is working closely with other States and Provinces in the Western Climate Initiative (WCI) to design a cap-and-trade program that can deliver significant GHG reductions throughout the region from each of the Partner jurisdictions. ARB will develop a cap-and-trade program for California that links with the programs in the other WCI Partner jurisdictions. Other WCI Partner jurisdictions will do the same, creating a western regional emissions reduction program.[2] ARB will continue to work with the WCI Partner jurisdictions to ensure that the resulting program design is one that provides real emission reductions and enables the California program to meet all the requirements

[1] "The Acid Rain Program and Environmental Justice: Staff Analysis" (September 2005) U.S. Environmental Protection Agency, Office of Air and Radiation, Clean Air Markets Program.
[2] The WCI Partner jurisdictions released the program design document on September 23, 2008. The WCI program design is summarized in this Appendix; the program design and supporting documents are reproduced in Appendix D.

of AB 32, including the need to consider any potential localized impacts, ensures market security (avoid gaming), and is enforceable .

Fundamentals of Cap-and-Trade

A cap-and-trade program establishes an enforceable limit (or cap) on the aggregate total emissions for those entities covered by the program. The cap is set for each compliance period of the program by the State, and emission reductions increase as the cap declines over time.

A key component of a cap and trade program is a permit, typically called an allowance. Each allowance represents a temporary permit to emit one unit of GHG emissions. In California, this unit would be one metric ton of carbon dioxide equivalent ($MTCO_2E$). Allowances are issued in the program in an amount equal to the total emissions limit for a compliance period. At the end of each compliance period, all entities in a cap-and-trade program must surrender allowances equal to their total emissions during the compliance period.

The limited number of allowances issued creates a binding cap on emissions, while issuing fewer allowances over time ensures declining emissions. The ability of allowances to be bought and sold creates an allowance price that reflects the marginal cost of reducing emissions. Unneeded allowances held by one entity can be sold to another source or banked for future use.

Cap-and-trade program rules will define specific compliance periods, at the end of which facilities would be required to surrender allowances equal to what they emitted. Failure of a facility to surrender sufficient allowances to cover their emissions would result in significant penalties. To maintain the environmental integrity of the system, non-compliance penalties must include purchasing and surrendering allowances at least equal to the facility's excess emissions.

New facilities that begin operation in sectors included in a cap-and-trade program would need to obtain allowances through an auction, from a reserve, or from other allowance holders. This process provides a mechanism for new facilities to operate while guaranteeing that there is no increase in overall greenhouse gas emissions when new facilities are built.

A cap-and-trade system could also allow facilities to retain or "bank" allowances for future use. Allowance banking provides an incentive for capped sources to reduce emissions below their allowance holdings in early periods with the knowledge that they can use or sell the extra allowances in the future. Where allowed, banking has been used extensively, resulting in greater early emissions reductions than would otherwise have taken place. Having allowances in the bank creates a hedge against any number of unexpected developments that could lead to higher-than-expected market prices.

Cap-and-trade program and regulatory measures

Because it sets a firm limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program complements other measures that may be adopted for capped sectors. The proposed cap-and-trade program would include up to 85 percent of the State's emission sources by 2020, covering the electricity, transportation fuels, natural gas, and industrial sectors. Overall, the cap represents a 147 $MMTCO_2E$ reduction from projected business-as-usual (BAU) emissions from the sources covered under the cap.

Emissions or energy use from most of the capped sectors would be reduced in part by measures other than the cap-and-trade program, including increased energy efficiency programs, the Renewables Portfolio Standard, the light duty vehicle greenhouse gas emission standards, and the Low Carbon Fuel Standard. Because such measures for capped sectors reduce the need for those covered by the cap-and-trade program to purchase and surrender allowances, these other measures benefit affected entities under the cap. In addition, the cap-and-trade program provides an enforceable limit on emissions that ensures that the reductions needed from the covered sectors occur. The emission reductions needed to meet the cap beyond those required by other measures would come from sources in the program that are able to reduce emissions in the most cost-effective manner.[3]

Western Climate Initiative

California is working within the Western Climate Initiative (WCI) to design a western regional market system. WCI is a collaboration of states and Canadian provinces established to develop regional strategies to reduce GHG emissions. Launched in February 2007, the WCI currently consists of the states of California, Arizona, Montana, New Mexico, Oregon, Utah, and Washington, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec. In addition to these Partner jurisdictions, six U.S. states, one Canadian province, and six Mexican states are participating in WCI as observers. The WCI Partner jurisdictions have set an overall regional goal for reducing GHG emissions, and are working together to develop a framework for the regional program. By participating in a western regional system, California maximizes its potential to achieve greenhouse reductions in the most cost-effective manner possible, helps create a system that will generate greater reductions than can be achieved by California action alone, and creates a level playing field for California businesses within the WCI region.

A cap-and-trade program is one element of the effort by the WCI Partner jurisdictions to identify, evaluate, and implement ways to reduce GHG emissions and achieve related co-benefits. The WCI Partner jurisdictions released recommendations for a regional cap-and-trade program in September 2008. Those recommendations and background documents providing additional information on the design are presented in Appendix D. These recommendations were developed collaboratively by the WCI Partner jurisdictions, including California, with a goal of achieving regional GHG reduction targets equitably and effectively. The WCI's recommendations are largely consistent

[3] For a further discussion of this issue, see Box 2-2, page 13 of the California Market Advisory report at: http://www.climatechange.ca.gov/market_advisory_committee/index.html

with the recommendations provided in June 2007 by the California Market Advisory Committee (MAC),[4] with the recommendations provided to ARB by the California Public Utilities Commission and the California Energy Commission in March 2008,[5] and the proposed decision issued by the two Commissions in September 2008.[6]

In addition to the work on developing a regional cap-and-trade program, the WCI Partner jurisdictions have committed to promoting increased energy efficiency, vehicle performance standards, promoting the development and use of clean and renewable energy resources, and advocating national and regional climate policies that reflect the needs and interests of western states, tribes and provinces. The Partner jurisdictions recognize that emission reduction limits ultimately established under the cap-and-trade program will need to be augmented with other strategies to reach the individual partner goals and the regional goal. Therefore, all the WCI Partner jurisdictions will continue to examine a wide range of complementary policies, including regulations, laws, and other measures at the state and provincial level as part of the analyses for a cap-and-trade approach.

While ARB is looking to participate in a regionally coordinated cap-and-trade program as developed through the WCI, the California program will need to meet the requirements of AB 32. The program would be integrated with the overall implementation of the range of regulatory measures and policies that the Board includes in the Adopted Scoping Plan. Participating in a cap-and-trade program will not excuse facilities from obligations imposed on them by other measures adopted under AB 32. Rather, reductions achieved through those other measures will result in reduced emissions and the need for fewer allowances to comply with the cap-and-trade program. With appropriate environmental safeguards in place, a regional cap-and-trade approach will result in statewide co-benefits of improved air quality and lower health-based risk from air toxics.

ARB would develop regulations to implement the cap-and-trade system by the end of 2010, based on the authority and requirements of AB 32, with the program beginning in 2012. This rule development schedule would be coordinated with that of the WCI timeline for a regional cap-and-trade program.

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[4] The Report, "Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California," was released in June 2007 and can be found online at: http://climatechange.ca.gov/market_advisory_committee/index.html. The Market Advisory Committee (MAC) consisted of a consortium of economists, policy makers, academics, government sector public servants, and environmental advocates who came together through the auspices of Cal/EPA, pursuant to Executive Order S-20-06 from Governor Arnold Schwarzenegger.

[5] Joint Agency Decision of the CEC and the CPUC, *Final Adopted Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*, March 13, 2008, CEC publication number CEC-100-2008-002-F..

[6] Joint Agency proposed final opinion of the CEC and the CPUC, *Proposed Final Opinion on Greenhouse Gas Regulatory Strategies*, published September 12, 2008 and to be considered for adoption on October 16, 2008 by the CEC and the CPUC. The document is CEC publication # CEC-100-2008-007-D, available through links at: http://www.energy.ca.gov/ghg_emissions/index.html and is also known as CPUC Proposed Decision of September 12, 2008, CPUC Proceeding R06-04-009 posted at http://docs.cpuc.ca.gov/EFILE/PD/89317.htm.

Draft program design summary

Scope: The scope of a cap-and-trade program defines the emission sources and types of gases included within the program. Compared to direct regulations alone, a broad-based cap-and-trade program is likely to yield additional opportunities for lower cost reductions, thereby reducing the cost of achieving the overall emission target. However, other considerations must also be weighed in determining program scope. These include the ability to monitor, report, and verify emissions to a high degree of accuracy; the incorporation of adequate environmental safeguards to prevent harm in communities that already experience disproportionate impacts that affect their health and air quality; the potential for economic impacts on industry or consumers; and the effectiveness of the cap in providing incentives for emission reductions in different sectors.

The proposed cap-and-trade measure phases in the following sectors:

Starting in the first compliance period (2012):

- In-state electrical generating facilities that emit over 25,000 metric tons CO_2E per year,[7] including imports not covered by a WCI Partner jurisdiction
- Large industrial facilities above 25,000 metric tons CO_2E per year, including high global warming potential gases[8]

Starting in the second compliance period (2015):

- Upstream treatment of industrial fuel combustion at facilities with emissions at or below 25,000 metric tons CO_2E per year, and all commercial and residential fuel combustion regulated where the fuel enters into commerce[9]
- Upstream treatment of transportation fuels regulated where the fuel enters into commerce

As required under AB 32, California will account for and regulate emissions from all electricity produced and consumed in the state, including electricity from both in-state generation and out-of-state generation. This requirement could be met through a regionally coordinated cap-and-trade program with a generator-based approach if all jurisdictions in the Western Electric Coordinating Council (WECC) were participating.

If some WECC jurisdictions do not link with the WCI cap-and-trade program, a first jurisdictional deliverer approach that covers all emissions generated in WCI and all emissions attributable to electricity delivered in WCI but generated outside WCI, or some

[7] Allowances will not be required for emissions from combustion of carbon-neutral projects.
[8] The Scoping Plan is also proposing an emissions fee on high GWP gases. This proposed measure would be assessed upstream on the sale of these gases or products containing these gases in California. If during rule development, ARB determines that assessment of this fee and inclusion of industrial process emissions of high GWP gases are duplicative, it will determine which approach would lead to the most cost-effective reductions.
[9] For a description of 'upstream' versus 'downstream' coverage, see Chapter 4 of the Market Advisory Committee Report.

similar method, will be needed to address emissions from electricity imported into California from non-participating jurisdictions. This approach is generally consistent with the recommendations from the MAC and the approach recommended to ARB by the California Public Utilities Commission and the California Energy Commission based on their joint proceeding for implementing AB 32 in the electricity sector.

For energy intensive industrial sources, such as cement manufacturing, stringent reduction requirements in California, either through inclusion in a cap-and-trade program or through direct regulation, have the potential to drive manufacturing activity out of California unless those locations have similar requirements (e.g. WCI). This type of 'leakage' can result in reduced employment and economic activity in California without reducing overall greenhouse gas emissions. Several policy options offer the potential to minimize this leakage by including consideration of emissions outside of California associated with the production of products eventually sold into the California market. [10] ARB is evaluating these policy options including life cycle intensity standards and allowance allocation/submission strategies that account for out of state emissions, and will coordinate with the other WCI Partner jurisdictions on these issues.

Setting the Cap for California: The Scoping Plan must be designed to meet the AB 32 goal of reducing statewide emissions to 1990 levels by 2020. To meet that target, the emissions allowed under a cap-and-trade program, plus expected emissions from sources not included under the program's cap, must be no greater than the 2020 emissions goal. This cap must also be realistic in terms of the emission reduction opportunities within the capped sectors.

As shown in Table 1, a preliminary estimate of the GHG emissions cap in 2020 for the sectors included in the cap-and-trade program is 365 $MMTCO_2E$. This covers about 85 percent of California total GHG emissions in 2020.[11] Capped sectors would include electricity, transportation fuels, natural gas, and large industrial sources. Emissions or energy use from most of the sectors covered by a cap-and-trade program would also be governed by other complementary measures, including performance standards, efficiency programs, and direct regulations.

[10] The cement sector is an example of a sector that may be susceptible to this type of leakage, and the Draft Scoping Plan included consideration of a measure to institute an intensity standard at concrete batch plants that would consider this type of life-cycle emissions. While this measure is not recommended in this Proposed Plan, ARB will evaluate whether this type of intensity standard could be incorporated into the cap-and-trade program or instituted as a complementary measure during the cap-and-trade rulemaking.
[11] The actual cap for the program will be established as part of the rulemaking process. The preliminary cap of 365 $MMTCO_2E$ assumes that all of California's electricity imports would be covered under a California cap. Because a significant portion of California's imported electricity is from power plants located in other WCI Partner Jurisdictions, emission from those sources could be included in the cap of the states within which the power plants are located. In establishing the California cap, ARB will need to consider the degree to which emissions from these sources are addressed as part of the WCI regional market.

Appendix C: Cap and Trade
Table 1 Sector Responsibilities under Cap-and-Trade Program
($MMTCO_2E$ in 2020)

Sector	Projected 2020 Business-as-Usual Emissions		Preliminary 2020 Emissions Limit under Cap-and-Trade Program
	By Sector	Total	
Transportation	225	512	365
Electricity	139		
Commercial and Residential	47		
Industry	101		

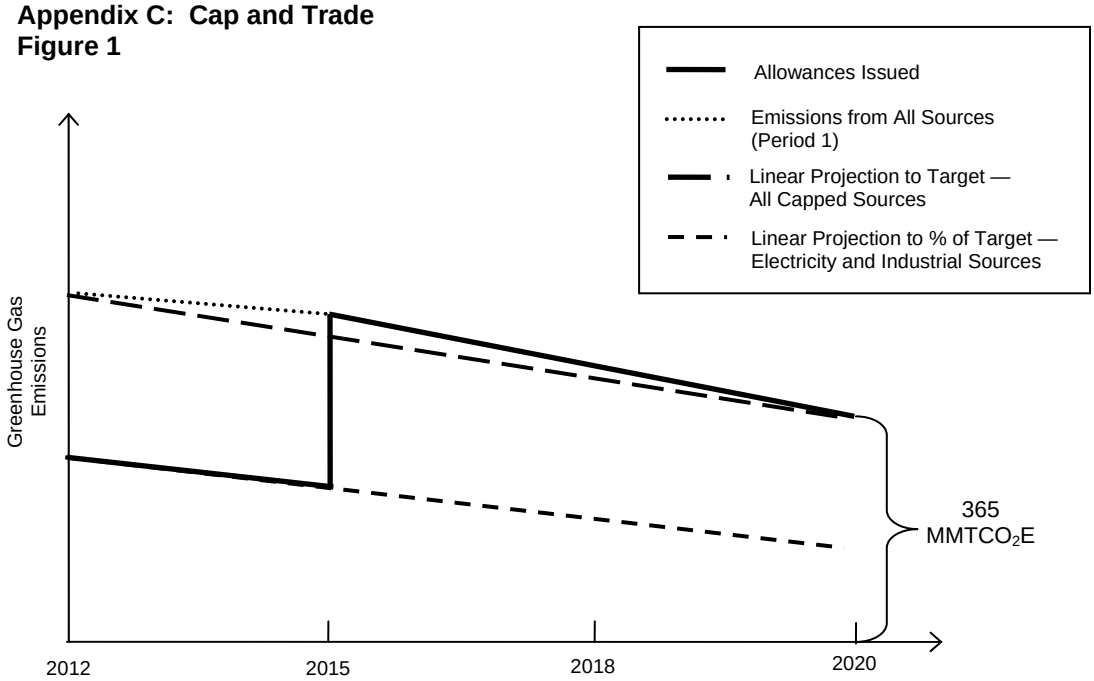
In developing the Preliminary Recommendation that was included in the Draft Scoping Plan, ARB, working with other Climate Action Team agencies, conducted a broad review of possible emission reduction strategies for all sectors of the California economy. This review resulted in identification of the broad range of measures included in the Draft Plan, both as recommended measures and as measures still under evaluation. Considered together, the full set of measures provided possible reductions between 120 to more than 150 $MMTCO_2E$ from BAU projections for the capped sectors. The preliminary emissions limit of 365 $MMTCO_2E$ in 2020 that was included in the Draft Plan would require emission reductions of 147 $MMTCO_2E$, which was a realistic level given the range of measures that were recommended or being evaluated.

ARB has determined that some of the measures for these sectors that were still under evaluation in the Draft Scoping Plan are not appropriate to pursue as regulations. However, for many of them, the types of reductions that were being evaluated are likely to be undertaken by facilities covered by the cap-and-trade program in the locations where they are most cost effective. ARB believes, based on the review of emission reduction opportunities conducted for the Scoping Plan, that significant reduction opportunities exist in the industrial sector that are more readily achieved through market mechanisms than through direct measures.

For these reasons, ARB believes that the preliminary limit of 365 $MMTCO_2E$ recommended in the Draft Scoping Plan remains a reasonable and appropriate cap.

The 2012 cap and the trajectory of the cap between 2012 and 2020 could greatly impact the success of the cap-and-trade program. The WCI Partner jurisdictions have proposed a trajectory similar to that shown in Figure 1. The 2012 cap will be set at a level that can be meet with the technologies and regulations in place in 2012 and the trajectory will be established as a straight-line reduction in the cap between 2012 and 2020, with an adjustment in 2015 to account for the sectors added to the program at the start of the second compliance period.

Appendix C: Cap and Trade
Figure 1



As California links to the WCI Partner jurisdictions' programs to create a regional trading market, California's cap and apportionment will be consistent with the AB32 economy-wide emissions goal. The ultimate success of WCI will depend on the ability and willingness of all partners to maintain their commitment to meeting their economy-wide GHG emission reduction goals. A firm regional cap with strong reporting and enforcement rules will provide a high degree of certainty that emissions will not exceed targeted levels. ARB will ensure the system as a whole has integrity before California participates in the WCI market system.

Reporting: ARB's mandatory GHG reporting regulations provide a solid foundation for establishing a cap-and-trade system. As a cap-and-trade program is developed, these reporting requirements will be tailored to that program design.

Because sources in the program would be required to submit allowances equivalent to the reported level of their GHG emissions, accurate measurement and reporting of all emissions covered by the cap would be required to assure accountability, establish the integrity of allowances, and sustain confidence in the program. Additionally, all market participants need accurate reporting to make decisions on whether or not to buy, sell, or bank allowances. Penalties for non-compliance need to be both certain and stringent enough to ensure that all capped sources have a clear incentive to comply. The WCI program design would require facilities to obtain and surrender three allowances for

every metric ton of CO2e not covered by an allowance at the deadline, and allows Partner jurisdictions to include other penalties.

Allocation: Allocation is the process by which emissions allowances are periodically distributed under an emissions cap-and-trade system. Allowances can be distributed in a number of ways: through auctions, free distribution, or a combination. As was noted in the MAC report, the allowance allocation method will have a significant effect on how "the economic impact of a cap-and-trade system is distributed among regulated entities, consumers and other parties."[12]

ARB will establish the details for distribution of allowances within the general guidelines established in the WCI program design framework. WCI Partner jurisdictions have agreed to a minimum percentage of allowances auctioned increasing from 10 percent in the first three-year compliance period to 25 percent in 2020. The WCI is also proposing the use of an allowance reserve price for a certain percentage of allowances in the regional cap. Such a reserve will help to ensure that the cap is binding and that reductions that can be achieved for less than the reserve price are pursued. The allowance reserve also provides the opportunity for the regional cap-and-trade program to provide reductions that exceed the regional target.

Each WCI Partner jurisdiction, including California, is free to auction a greater portion of its allowance budget in any compliance period. The distribution of California's allowances and the percent auctioned would be determined during the cap-and-trade rulemaking process. The California Public Utilities Commission and the California Energy Commission have considered this question of free allocation or auction of allowances in their joint proceeding on implementation of AB 32 for the electricity and natural gas sectors. They have recently released a proposed decision that recommends to ARB a transition to 100 percent auction for the electricity sector by 2016.[13] The MAC also recommended a transition to full auction within the cap-and-trade program, noting that a system in which California ultimately auctions all of its emission allowances is consistent with fundamental objectives of cost-effectiveness, fairness and simplicity.[14] ARB agrees that a transition to a 100 percent auction is a worthwhile goal for distributing allowances. However a broad set of factors must be considered in evaluating the potential timing of a transition to a full auction including competiveness, potential for emissions leakage, the effect on regulated vs. unregulated industrial sectors, the overall impact on consumers, and the strategic use of auction revenues..

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[12] Market Advisory Committee, "Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California," June, 2007, [http://climatechange.ca.gov/market_advisory_committee/index.html], p. 55

[13] Joint Agency proposed final opinion of the CEC and the CPUC, *Proposed Final Opinion on Greenhouse Gas Regulatory Strategies*, published September 12, 2008 and to be considered for adoption on October 16, 2008 by the CEC and the CPUC. The document is CEC publication # CEC-100-2008-007-D, available through links at: http://www.energy.ca.gov/ghg_emissions/index.html and is also known as CPUC Proposed Decision of September 12, 2008, CPUC Proceeding R06-04-009 posted at http://docs.cpuc.ca.gov/EFILE/PD/89317.htm

[14] Page 55-60, MAC report.

For any allowances that are distributed for free, ARB, in concert with other WCI Partner jurisdictions, will decide who should receive allowances and on what basis. For example, free distribution can be based on performance standards (benchmarks), historical emissions (grandfathering), or some other relevant metric. The MAC recommended that the State initially retain flexibility to allocate some of the allowances free of charge as a means of managing competitiveness and economic transition issues, but that any initial free distribution be limited to those entities that are not able to pass through costs to consumers and should quickly transition to a full auction with strategic use of the proceeds. In addition, the MAC recommended that any free allocation of allowances be based on environmental performance benchmarks, and that the auction process be designed to encourage voluntary early reductions by firms, municipalities, and individual consumers.

With an auction, the primary decisions relate to design of the auction process and what to do with the auction proceeds. ARB will work with the WCI Partner jurisdictions to develop a coordinated regional auction process that will allow California and the other WCI Partner jurisdictions to auction allowances throughout the WCI region and receive their proceeds from the auction.

The State may want to incentivize certain actions and activities through the allocation process. This can be accomplished through allowance set-asides. An allowance set-aside is a pool of allowances which are distributed using criteria alternative to the primary method of allocation. Allowance set-asides direct a certain portion of allowances from within the cap to recognize actions previously taken or further incentivize future actions which benefit the policy goal. Allowance set-asides could be used with any method of allocation and can provide a permanent or temporary means for incentivizing certain actions. It is important to note that there will be a fixed number of allowances for California and those allowances will have a direct financial value in the program.

Given that allowance allocation and revenue use decisions have the potential to greatly affect the equity of a cap-and-trade system, addressing both these issues will be a major part of the rulemaking process. ARB will seek input from a broad range of experts in an open public process regarding the options for allocation and revenue use under consideration by ARB and the WCI Partner jurisdictions.. This process will evaluate various mechanisms ARB is considering for allowance distribution and potential uses of allowance value, including the recommendations offered by CPUC and CEC. In order to incorporate the broadest cross-section of views, the ARB will provide for significant stakeholder involvement and interaction throughout the process. Input and perspective from representatives involved in the WCI partnership and federal climate policy efforts will be included. Issues to be considered will include the appropriate timing and structure of a transition to full auction of allowances, the potential need to harmonize allocation regionally by sector with our WCI Partner jurisdictions and intra-sector equity here in California. Among the principles that ARB will follow in developing its recommendations to the Board on these issues are the following:

- Minimize the economic burden of the program on consumers (especially low-income consumers), workers, local governments, and businesses

- Ensure fair treatment amongst and within included sectors—including new market entrants
- Minimize cost volatility for covered sectors
- Maximize market liquidity and minimize opportunities for market manipulation
- Avoid GHG leakage and overall employment loss
- Recognize and reward early action from covered sectors
- Avoid windfall profits and other unnecessary wealth transfer
- Encourage energy efficiency and the development of low GHG-emitting technologies
- Avoid criteria and toxic air pollutant emissions increases, especially in communities already disproportionately impacted by those pollutants

Further, the ARB should consider funding for adaptation to and further mitigation of climate change, and evaluate the role of offset levels and costs and the implications for allocation.

Offsets: Within the context of a cap and trade program, ARB would adopt regulations for verifying and enforcing any offsets used. Offsets can provide regulated entities a source of low-cost emission reductions, and can encourage the spread of clean, efficient technology within and outside California. The locations of offset projects are an important consideration.

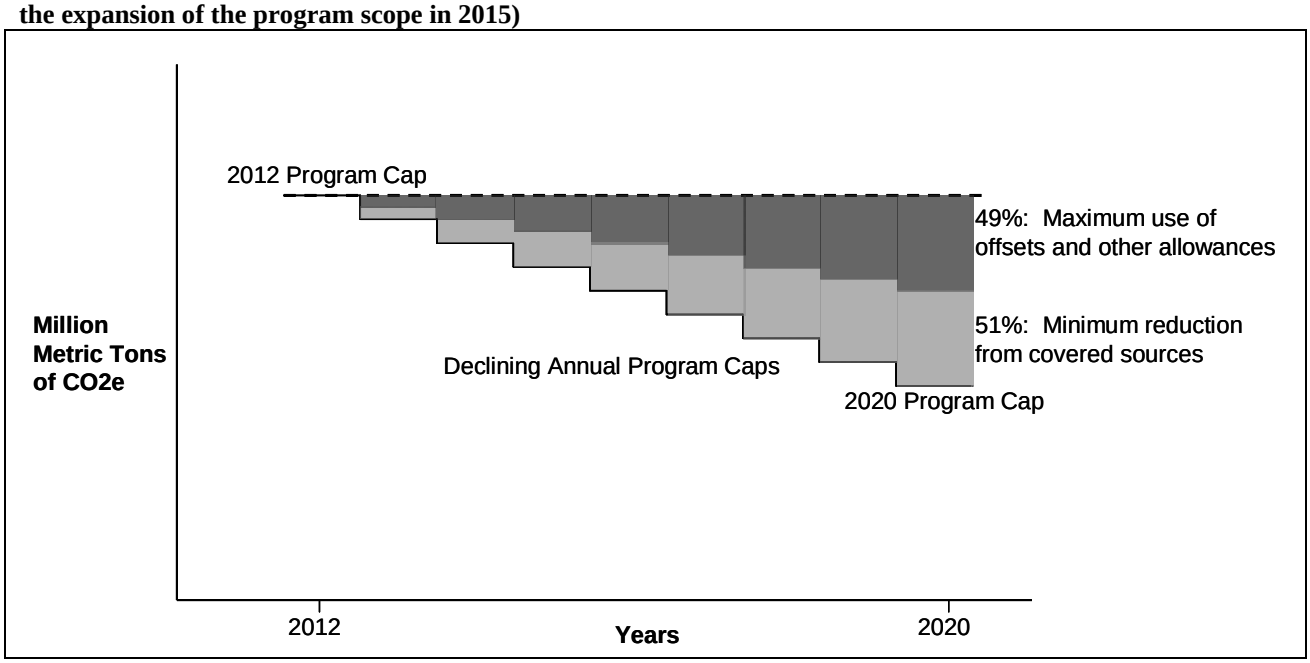
In developing this offsets program, California will work with the WCI Partner jurisdictions to ensure that the western regional market includes clear and consistent rules for use of offsets. For compliance purposes, the WCI Partner jurisdictions are considering allowing individual regulated entities to use a limited amount of tradable units (offsets and allowances) from other government-regulated GHG emission trading systems. To be used for compliance, the WCI Partner jurisdictions would need to formally recognize such units as meeting similarly rigorous criteria for environmental performance. Limits are also being considered on the amount of offsets and non-WCI tradable units that could be used for compliance by individual regulated entities.

High quality offset projects located outside California can help lower compliance costs in California while reducing GHG emissions in areas that would otherwise lack the resources needed to do so. Projects in the Mexican border region may be of particular interest, providing the opportunity to realize considerable co-benefits on both sides of the border. Additionally, defining project types related to imported commodities (such as cement) would enable California to provide incentives to reduce emissions associated with products that are imported into the state for our consumption.

ARB will establish a quantitative limit on offsets to ensure that a majority of the required emission reductions come from within the capped sectors. This type of quantitative limit would help achieve meaningful emission reductions from capped sources while leveraging opportunities for lower-cost reductions that offsets can provide. Because some goals of the AB 32 program, such as the development of clean, innovative and pioneering technologies, require reductions to occur within the California energy

economy, it is important that meaningful emission reductions are achieved from actions taken at capped facilities throughout the program. The WCI program design states that no more than 49 percent of each Partner jurisdiction's total emission reductions come from offsets or other trading systems (see Figure 2). This requirement ensures that a majority (at least 51 percent) of emissions reduction come from within capped sectors. Furthermore each Partner jurisdiction has the opportunity to establish a tighter limit within its jurisdiction. ARB will establish a limit of at most 49 percent and apply this limit to each of the compliance period and will work with our WCI Partner jurisdictions to do the same to ensure real reductions from capped sectors within the first compliance period.

Figure 2: Illustration of the 49 Percent Offsets Limit (for simplicity, this illustration does not show the expansion of the program scope in 2015)



Offset projects can potentially be located throughout the world. Concerns about the geographic scope of an offset program relate to how effectively projects can be evaluated, monitored, reported, and verified within the system by the program authority. The development of offset projects located within California's borders will help capture the public health, social and environmental co-benefits within the state that are associated with some offset projects.

While allowing offset projects from outside California to count for compliance under AB 32 could result in fewer reductions occurring within the state, and so reducing the local economic, environmental and public health co-benefits from GHG emission reductions, out-of-state projects can still have significant advantages. Beyond simply improving the economics of the cap-and-trade program, acceptance of out-of-state offsets demonstrate that Californians recognize the global nature of the climate crisis and demonstrate our commitment to developing a global solution. Rapidly escalating greenhouse gas emissions in developing countries can negate efforts undertaken in

California unilaterally. Because California is part of the global economy, our demand for manufactured goods create greenhouse gas emissions outside the boundaries of our State. California is committed to working at the international level to reduce greenhouse gas emissions globally and finding ways to support the adoption of low-carbon technologies and sustainable development in the developing world. Therefore, ARB would work in the rulemaking with our WCI Partner jurisdictions to establish an offsets program without geographic restrictions that includes sufficiently stringent criteria for creating offset credits to ensure the overall environmental integrity of the program.

One concept being evaluated for accepting offsets from the developing world is to limit them to those jurisdictions that pledge to achieve a greenhouse gas intensity target in certain carbon intensive sectors (e.g. cement). This could be achieved through a joint agreement with California to develop a minimum performance standard ("sectoral benchmarking"). Such agreements would encourage early action in developing countries toward binding commitments and could also reduce concerns about competiveness and risks associated with carbon leakage.

Next steps on program design

If the Board adopts this proposal, ARB will initiate regulatory development for a cap-and-trade system, working in close coordination with the other WCI Partner jurisdictions. Starting in January 2009, ARB will initiate outreach to stakeholders to establish a formal structure for involvement. Invitations to participate in the process will be extended to the regulated community, environmental and community advocates and other public interest groups, prominent academics with expertise in cap-and-trade issues and new technology development, local air pollution control districts, regional players in the WCI, and other State agencies with existing authority for regulating capped sectors. This process will integrate practical economic and administrative design considerations within the program to address environmental and public health concerns within already adversely impacted communities.

In order to develop comprehensive regulations for the cap-and-trade program, ARB, in cooperation with the aforementioned stakeholder groups and climate policy partners, will address key issues through a series of stakeholder working group and technical group meetings. ARB will need to develop specific regulatory language to address a wide range of issues, including but not necessarily limited to the following:

- California's allowance budget in 2012
- California's allowance budget in 2015 with inclusion of transportation fuels and natural gas
- The trajectory of the allowance budget between the compliance periods
- The threshold for inclusion in the cap-and-trade program
- The length of the compliance period
- The design of the auction
- Limitations (if any) on banking of allowances
- Method of allowance distribution
- Use of auction revenue
- Rules for use of offsets

- Recognition for early action
- Recognition for voluntary action
- Rules for and potential limits on trading
- Methods for ensuring that criteria and toxic pollutants do not increase in communities already disproportionately impacted by them
- Reporting and verification of compliance
- Enforcement and penalties for non-compliance

Another important consideration of the stakeholder and technical working groups will be establishing a methodology for tracking program success. By identifying metrics for success at the start of the program, ARB will be able to collect and more quickly analyze critical data as the program progresses.

As each of these issues is addressed to the satisfaction of ARB and the working groups, ARB staff will begin to draft regulations for the specific elements of the California cap-and-trade program. All regulations for the program will need to be adopted by the Board by January 1, 2011 for an implementation date of January 1, 2012.

2. STATE GOVERNMENT

This section includes the following subchapters:

Business Travel
State Fleet
Facilities
Energy Production/Procurement & Non- Facility Energy Use
Environmentally Preferable Purchasing
Employee Practices
State Government's Carbon Shadow

The sector-specific CAT subgroups worked closely together to develop this section of the Plan. This input was evaluated and analyzed by ARB and is reflected in the write-up of this section.

Overview

State government includes college campuses, veterans homes, medical, military, and law enforcement facilities, prisons, parks, water, energy and public works projects, and hundreds of office buildings, each having its own specific carbon footprint. With approximately 356,000 employees at more than 100 agencies, 290 million square feet of building space, 50,000 vehicles, and $6 billion in annual goods and services procurements, State government is a considerable source of GHG emissions and must do its share to reduce emissions.

State government must play a leadership role in reducing greenhouse gas emissions (GHG), not only as a regulatory entity that creates programs to reduce emissions from industry, commercial endeavors, and the general public, but also by reducing emissions from its own facilities and operations. This section focuses on State government facilities and operations and on the State Government's "Carbon Shadow". State government is committed to reduce its own GHG emissions by 30 percent in 2020 – a 15 percent reduction from current levels.

Many agencies have taken aggressive approaches to energy conservation and efficiency, however, a system-wide approach to reduce GHG emissions is still in the early stages. The priority system-wide approaches to State government's emission reductions should include:

- Focus on energy efficiency and resource conservation. Immediate and significant emission reductions can be easily attained through simple steps to conserve the energy we do use.

- Adopt a system-wide GHG reduction policy that encourages a reduction in both vehicle and air travel. Since travel is such a large source of emissions, a policy

will provide strong support for telecommuting, alternate work week schedules and tele- and video conferencing.

- Establish an inventory of GHG emissions from State government projects and operations. This is critical to establishing a baseline from which impact and progress can be measured. Register with the California Climate Action Registry or similar climate registry to facilitate the process.

- Conduct a review of laws, regulations, policies and procedures to evaluate their effect on the procurement of vehicles. Over the years, older mandates can become contradictory or redundant when newer directives are added. A review will identify where clarification is necessary.

- Require each board, department, office to coordinate and integrate GHG reductions in all areas of their operations in concert with program services delivery to ensure that all aspects minimize GHG emissions.

- Take advantage of current and future technologies to reduce GHG emissions. Through strategic automation and consolidation of cross-departmental processes and effective use of the Internet, staff can reduce paper and energy use while dramatically improving service to the public and regulated entities. E-government, appropriately designed, enables government to better meet its business needs by delivering timely and efficient services, greater transparency and better access.

- Reduce, reuse, recycle, and buy environmentally preferred goods and services. Solid waste management practices are a quick, easy, and effective area to focus efforts to reduce the amount of products and materials being used, to get the maximum use out of them, and to ensure recycling occurs at the end of their useful life. Purchasing products that have recycled-content, and are energy efficient, long lasting, and easily repaired, maximizes the economic and environmental benefits from the purchases that are made.

The remainder of this section will discuss current and potential future GHG emission reduction efforts within business travel, state fleet, facilities, energy production, procurement and non-facility use, environmentally preferable purchasing, employee practices, and the State government's "Carbon Shadow".

A. BUSINESS TRAVEL

Transportation is one of the largest emission sources. Minimizing travel whenever possible and choosing the least emitting mode when transportation is necessary will yield GHG reductions. Reducing travel related emissions results in correlating reductions in fuel, maintenance, and vehicle replacement expenditures. This is an opportunity for

significant cost savings while having a minimal impact on the services the State government provides.

GHG Reduction Efforts

With budgets tightening and costs rising, many agencies have already responded by limiting travel. Some travel is always necessary as many types of work, events, and presentations must be conducted in person. However, there are many opportunities to minimize travel by relying more on video conferencing, teleconferencing and similar meeting and information sharing technologies.

The Department of General Services' (DGS) current vehicle rental contract offers hybrid, low emission, and high efficiency vehicles. Advanced requests may be needed to ensure a vehicle is available when needed, but emphasizing the need for these vehicles, will increase their availability. Alternate fuel and bio-fuel vehicles, including ethanol (E-85), compressed natural gas (CNG), and electric hybrid vehicles are available through the State garage and should be used to the maximum extent possible. Because of the increased availability of flex-fuel vehicles, an ethanol pump has been installed at the State garage in downtown Sacramento and at the California Highway Patrol facility in West Sacramento. Also, ARB is working on a low carbon fuel standard (LCFS) that will reduce emissions from fuel use throughout State government and California.

Some agencies and campuses are making use of electric carts and bicycles for short local trips. Groundskeepers and maintenance staff also find carts and bikes are quick and easy ways to get around.

Potential Future Efforts

State government should consider a statewide policy limiting air and vehicle travel and requiring an analysis of the least emitting travel options to the most travelled destinations. Agencies should encourage greater use of public and alternative transportation for State employee travel. Especially in areas of high density state offices, incentives and policies that promote the benefits of walking, riding bikes, and using electric carts for short, local trips should be established. These zero emission transportation options should be expanded upon to increase their availability and use.

DGS has a number of initiatives to encourage the State employees to travel "greener" and "smarter." A requirement for contractors to provide accurate and timely reporting data to DGS will enable the department to determine emissions of State travel activities. Improving travel services through airline, automobile rental and credit card vendors could also make travel more efficient. Following a common practice of most trucking and delivery services, GPS tracking of certain percentages of fleet vehicles would foster better understanding of travel routes and provide for coordinated trip planning and alternative fueling stations.

The State car rental contracts expire in 2008 providing an opportunity to increase the supply of alternative and hybrid vehicles in the contracts. Automobile rental vendors currently under contract with the State, nationally operate 73,000 flex-fuel cars and trucks

that can use E-85, along with 4,000 hybrid cars. The State's new contract should require car rental companies to provide alternative fuel and hybrid vehicles to State employees traveling on business. Earlier this year, one of the State's automobile rental vendors, launched a car-sharing program, enabling downtown dwellers, State employees who carpool, or those who use mass transit to rent hybrid cars by the hour for use during the day. DGS Fleet should pilot this program in larger cities in the state.

The State airline contract is also up for renewal this year, and language should be incorporated into the contract that requires airlines to calculate emissions on frequently traveled pairs of city destinations for State business. This data should be provided to DGS on a quarterly basis to enable more strategic travel planning. City destinations should be selected that require less auto travel to get to meeting locations, and alternative means of travel or the use of video and teleconferencing technology should be considered.

DGS will also host the State Green Lodging Program. As part of this program, DGS will instruct State agencies to book certified green and sustainable hotels/motels for their overnight stays. Also, DGS Fleet is planning to develop a Meeting & Conference Unit, which will provide State agencies with meeting planning services. The unit will recommend that agencies book their lodging in the same hotel they have scheduled meetings and conferences whenever possible to minimize travel to and from the location.

Agencies will be encouraged to use pre-arranged shuttle transportation from car rental companies and hotels to and from the airport. DGS Fleet also plans to centralize taxi cab service and will require contracted taxi companies to provide emissions data to DGS and to incorporate alternative fuel vehicles into their fleets. DGS will continue to encourage the use of local transit and alternative fuel van shuttle services.

B. STATE FLEET

This sub-section consists of practical strategies on coordination, vehicle management, and operations that State government should implement to reduce the emissions of its own fleet. Many of the recommendations can be applied to fleets and vehicles outside of State government, such as cities, counties, and the private sector. It is also acknowledged that the measures taken to reduce GHG emissions must be coordinated with other existing state and federal laws and regulations. Because many of these recommendations are extensions or expansions of existing efforts, this section does not follow the format of the other sections.

The State fleet consists of approximately 50,000 vehicles and pieces of mobile equipment, operated by over 100 entities. About 40,000 of the State's vehicles are light-duty, passenger vehicles. The State fleet represents about 0.2 percent of the 33 million

vehicles registered with DMV and accounts for about 0.34 MMTCO2E per year of GHG emissions[15].

This section is focused on the executive branch, but State agencies should actively share information and practices with the UC, CSU, and Community College systems, local agencies that purchase vehicles through State contracts, and federal agencies. This sharing and coordination can be achieved through a statewide task force of agencies with fleets and/or with an interest in vehicle emissions.

Actions to reduce GHG emissions include the conversion of the California Highway Patrol (CHP) Fleet to Ethanol-85 vehicles and the installation of E-85 pumps at the CHP West Sacramento Fleet facility and at the DGS State garage in downtown Sacramento. These and many other efforts, as described below, have been implemented, but may have a long lead time before realizing substantial reductions.

Coordination & Information Management Strategies

A single database that contains detailed information on each vehicle with fuel use and maintenance history will improve the management and emissions calculations of the fleet. At the end of 2008, DGS Fleet is due to complete the installation of an automated Fleet Asset Management System (FAMS) to capture this data from State agencies and fuel purchasing systems. State agencies should report their entire fleet into FAMS to insure the most accurate emissions calculations and other vehicle related metrics.

As FAMS improves the coordination and information management of fleet data, it will identify how agencies can operate “leaner and cleaner” fleets– practices that could be modeled and implemented statewide. FAMS can also be used to create best practices to be shared with all State agencies, local jurisdictions, and private sector fleets.

To increase the State government’s cognizance of vehicle procurement and sales, DGS Fleet should work with the DOF and the DMV to consider becoming the title-holder for State vehicles. A reduction in the number of title-holding entities from about 100 to just a few could make fleet data far more accurate, which would enable the State to set and monitor proactive objectives to meet the goal of reducing State government emissions by 30 percent. This would require a major reorganization of DGS Fleet resources to provide efficient service to operating agencies and to insure a close working relationship with the DMV. The State Equipment Council exists to assist in the management of the state’s mobile assets, so DGS Fleet should also work through the Council to determine whether or not to proceed with this recommendation.

Vehicle Management Strategies

One of the fastest ways to reduce fleet emissions is to replace old vehicles with new, more efficient ones. Vehicles often stay in the fleet for ten years or more and, with age, become less efficient and require more maintenance. At some point, it is a better investment to procure replacement vehicles. Also, newer vehicles usually have more

[15] Calculations derived from ARB, Feb 28, 2008 AB32 Implementation Update: Transportation. Information by fuel is available at http://www.arb.ca.gov/cc/inventory/data/data.htm

advanced pollution control systems than older vehicles, reducing smog-forming co-pollutants. State agencies should identify the most polluting vehicles in the fleet and replace those vehicles as a priority. With FAMS information, DGS Fleet, DGS Procurement, and the Bureau of Automotive Repair should work with operating agencies to present cost-benefit analyses of vehicle replacement.[16] During this process, DGS Fleet should work through the State Equipment Council to identify inefficient vehicle assignments and work to consolidate those assignments to reduce the overall number of vehicles in the fleet.

Fuel Use

About 43 percent of the fuel used by the State fleet is purchased at private sector gas stations. DGS Fleet is working with Caltrans and US Bank, manager of the Voyager Fleet Credit Card system, to identify the locations of these gas stations. With this information, ARB and CEC should direct alternative fuel infrastructure funds to locations with the highest amount of State use to make the fueling of the State's alternative fuel vehicles as easy and convenient as possible.

To analyze State government's use of transportation fuels, DGS Fleet should develop a comprehensive, annual report of fuel use and make it available to the public online.

Alternative fuels, hybrids, and infrastructure

An immediate, concerted effort is needed to make alternative fuel available to State vehicles and the private sector. Considering the array of alternative fuel technologies available today, a portfolio for the State fleet, in the near term, should mostly consist of biofuels, hybrids, electric, and CNG. Additionally, ARB is developing a Low Carbon Fuel Standard that will reduce emissions by reducing the carbon intensity of fuel sold throughout California.

To comply with federal Energy Policy Act[17] (EPAct) and other laws, State agencies have adjusted their procurement policies to buy alternative fuel vehicles. The principal technology that California's fleet and many others have adopted is flex-fuel E85 (flexible-fuel from 100 percent gasoline to 85 percent ethanol/15 percent gasoline). Today, there are over 3,000 flex-fuel vehicles in the State fleet, and possibly 350,000 flex-fuel vehicles[18] on the road in California.

The use of biofuels is detailed in the State's Bio-Energy Action Plan, the Low Carbon Fuel Standard, and the CEC's Alternative Fuels Plan. But the implementation of these plans is limited by the lack of a robust infrastructure. Today, only four E85 pumps are available to the public, and there may be only a few more by the end of 2008. In contrast,

[16] The federal government keeps passenger vehicles for 3 years or 60,000 miles. See FMR 102-34.280 at http://tinyurl.com/3tum57
[17] The federal Energy Policy Act (EPAct 1992, 2005) requires certain fleets to purchase alternative fuel vehicles for 75 percent of their light-duty vehicles acquired in each model year (Sept 1 - Aug 31).
[18] According to the California Ethanol Vehicle Coalition, there are an estimated 350,000 flex-fuel vehicles in California. http://www.calevc.org/docs/CEVC1007Support.pdf

there are thousands of retail gasoline service stations in California.[19] As a result, the majority of the flex-fuel vehicles in the state currently operate on gasoline only.

Expanding the statewide infrastructure of commercial, alternative fuel stations could contribute to the reduction of emissions far more than any strategy that affects the State's fleet alone. A thorough review of existing regulations could lead to a streamlining of requirements while improving the needed safeguards. An immediate action must be to convene a taskforce of federal, state, and local regulatory agencies to design and implement a "one-stop-shop" for the permitting of alternative fuel manufacturing and distribution infrastructure. This program should be closely coordinated with funding from AB 1811 (2006, ARB), AB 118 (2007, CEC) and any federal programs.

For diesel vehicles, renewable diesel fuel is a viable option as most manufacturers warrant their engines for the use of renewable diesel fuel up to 20 percent (B20), although some are still limited to 5 percent (B5). A transition by Caltrans from 100 percent petroleum diesel to various percentages of renewable diesel fuel could result in a reduction of hundreds of thousands of gallons of petroleum diesel annually. Therefore, it is recommended that all State government bulk diesel contracts provide at least 5 percent (B5) renewable diesel fuel.[20]

Hybrid electric vehicles can make a significant reduction in petroleum use. Plug-in hybrid electrics promise to make an even greater contribution to the reduction in petroleum use, and therefore, emissions. DGS should work through the State Equipment Council to study the infrastructure needed to plug in the State government's dedicated-electric and plug-in hybrid vehicles where they are stored. State agencies should determine if their building electrical systems are sufficient for vehicle recharging. Based on the cost, which could be the cost of an extension cord in many cases, the State should consider funding the infrastructure as part of its strategy to reduce emissions.

Manufacturers no longer produce bi-fuel Compressed Natural Gas (CNG) vehicles, and only one manufacturer remains a bidder for annual State vehicle procurement contracts in the dedicated CNG passenger vehicle category. However, CNG, and its relative, propane, will probably continue to play important roles in centralized, municipal fleet operations, especially in non-attainment areas for criteria pollutants. Today there are only 193 natural gas fueling stations located in California.[21] Many of these stations have public access but do not recognize or accept the State's Voyager fuel card. While CNG remains in use by the State, DGS Fleet should work through the State Equipment Council to identify CNG and propane fueling stations and with US Bank to enable those stations to accept the Voyager card. This would make it easier for State employees to use the stations and increase the State's ability to track the use of these fuels.

[19] CEC, 2001-2002 data, http://www.energy.ca.gov/gasoline/gasoline_stations/index.html
[20] Renewable diesel includes low carbon biodiesel.
[21] DOE Alternative Fueling Station Locator: http://afdcmap2.nrel.gov/locator/FindNearResult.asp

Operations & Maintenance

Other strategies that can immediately reduce fuel use and emissions include a strict adherence to proper tire inflation pressures, correct viscosity oil use, replacing engine air filters based on environmental operating conditions, and properly recharging air conditioning units. Cruise control, though sometimes viewed as a luxury, should be required in State passenger vehicles as it can also reduce fuel consumption.[22]

DGS should work with CEC, ARB, and vehicle manufacturers to develop ways to efficiently reduce vehicle cabin temperatures. Some suggestions include passive air circulation, reflective roof paint, and improved window glazing. Vehicle air conditioning can use a significant amount of energy, and in most passenger cars today, the air conditioner is automatically engaged when using the windshield defrost. DGS Procurement should work with DGS Fleet and operating agencies to add a requirement to vehicle procurement specifications to enable the driver to control the use of the air conditioner in any air handling mode, and to ensure that vehicles are compliant with the requirements contained in the Pavley legislation.

For the last ten years, DGS Fleet has coordinated the use of re-refined motor oil throughout the fleet, which has contributed to a reduction in petroleum use. This program should be studied by an appropriate regulatory agency to determine its success and share any best practices with other fleets and the private sector.

There are additional best practices for vehicle maintenance that should be implemented. For example, the federal General Services Administration (GSA) manages the maintenance and repair of approximately 300,000 vehicles through five call centers that approve and track maintenance costs. Once call centers collect repair data from commercial vendors previously authorized to perform specific services, GSA notifies its fuel card provider (Voyager) to initiate payment of the charges. This system allows GSA to control maintenance and repair costs, and to collect operational data. Payments to vendors are also expedited using the Voyager card as a payment tool rather than utilizing the government's regular invoice payment system. Usually, this type of information is not collected by State vehicle operating agencies, but it has the potential to significantly improve the management of the fleet and reduce energy use and environment impacts. Therefore, it is recommended that DGS Fleet implement a program similar to GSA's.

C. FACILITIES

In large part, our primary objective in reducing GHG emissions is to reduce the amount of energy we use and to ensure the energy we do use is produced as cleanly as possible. In this Appendix, we have separated the discussion on energy use into two sections – Part C on facilities/building use and Part D on Non-facility energy use such as traffic signals and lighting for roadways, parks, tunnels, and bridges.

[22] ARB and CEC ongoing efforts on cool paints, tire inflation, cruise control, and air conditioning.

State government is taking aggressive action to "green" State buildings by implementing a wide variety of efforts to address climate change, reduce pollution and waste, and increase energy efficiency. According to DGS, the Executive Branch owns and operates 103 million square feet of building space – much of which is in the form of office buildings. A recent analysis of the 2004 California GHG inventory estimated that buildings represent approximately 25 percent of the total 480 $MMTCO_2E$ generated in 2004. For additional information on specific measures, see the Green Building section in part 7 of Appendix C.

GHG Reduction Efforts

In the following discussion, you will see many references to Leadership in Energy and Environmental Design (LEED). It is important to note that commercial buildings as defined by standard building codes are eligible for certification under a number of categories including LEED for New Construction (NC) and LEED for Existing Buildings (EB). There are also multiple levels to the rating system, including certification, or achieving higher silver, gold, and platinum levels.

Green Building Initiative

Executive Order (EO) S-20-04, known as the "Green Building Initiative" or GBI, requires State agencies to reduce the amount of electricity purchased from the grid that is used in State-owned buildings by 20 percent by 2015, and, in so doing, reduce greenhouse gas emissions associated with the production of fossil fuel-based power. It also requires all new and renovated State-owned facilities to be designed, constructed and operated as certified LEED Silver or higher buildings. The Governor's EO also urges all schools built with State funds to be resource and energy efficient.

Baseline & Benchmarking: Measuring a Building's Energy Performance

The EO also calls for benchmarking the energy performance of all State-owned buildings. The California Energy Commission's Benchmarking Workgroup, California utility companies, and State agencies are working collaboratively to measure the energy efficiency of State-owned buildings by using the federal Energy Star Portfolio Manager benchmarking tool.

In addition to analyzing energy performance against a baseline, State agencies can use benchmarking to compare a building with properties of similar characteristics, such as geographic location, size, operations and age. The Benchmarking Workgroup will collect and summarize energy consumption data provided by State agencies and will report annually on the progress toward attaining the energy reduction goal including recommendations on any changes in rules or procedures to ensure the goal is met.

New State Facilities

All new State government buildings and major renovations of 10,000 sq. ft. and over, subject to Title 24, are required to be designed, constructed and certified at a minimum of LEED-NC Silver or higher. Smaller buildings are being designed to meet LEED standards.

Some agencies, such as Caltrans, have adopted LEED standards for all in-house new construction and rehabilitation projects. In support of this effort, Caltrans project engineers and architects are working with DGS to become LEED certified. Caltrans is also near completion of a LEED policy directive that guides all internal facility projects.

Leased State Facilities

DGS and other State agencies are seeking U.S. EPA Energy Star rating for facility leases of 5,000 square feet or more beginning in 2006 for new leases, and beginning in 2008 for renewal leases (including meeting an Energy Star rating for purchasing or operating electrical equipment such as computers, printers, copiers, refrigerators, and unit air).

The State leases almost nine million square feet of office, storage and other space. Under EO S-20-04, preference is given to the most energy efficient buildings. California is seeking leases with a U.S. EPA Energy Star energy efficiency score of no less than 75 (out of a possible 100 points) or higher. In addition, LEED certification is being sought for build-to-suit (where the project will be built as the buyer or lessee specifies) leased facilities. The Department of Motor Vehicles (DMV) office in Riverside is the first build-to-suit lease that has been certified with a LEED Silver rating.

Existing State Facilities

The EO requires all existing State buildings larger than 50,000 square feet to meet LEED existing building requirements no later than 2015. A minimum of LEED – EB Certified is required to ensure energy-efficient, green building operations and maintenance, however, DGS has voluntarily increased this goal to LEED – EB Silver.

DGS has received approval from the U.S. Green Building Council, the architect of the LEED rating system, to participate in a pilot program for volume LEED-EB registration for the entire DGS-owned portfolio. This pilot program will be a major undertaking and yield major energy savings through product, system, and maintenance upgrades, while streamlining the LEED certification process.

The DMV has worked with the State's Investor Owned Utilities to identify energy conservation measures and accompanying incentives for its State-owned facilities. A DMV study indicates a potential for reduced annual electricity consumption by approximately 6 million kWh, about a 20 percent savings, which will equate to approximately a 2652 metric tons CO2E reduction of greenhouse gas emissions and a savings of over $750,000, each year. DMV is currently working with DGS to pursue a portfolio-wide approach to complete the identified measures.

Energy Efficiency by Retro-commissioning/Retrofitting

Statewide, commercial buildings (state owned and privately owned) use approximately 36 percent of the State's electricity and account for a large percentage of GHG emissions. Since the State government spends approximately $500 million on electricity per year for all State-owned buildings including the UC and CSU system, the State is committed to aggressively reduce building electricity usage. Executive branch buildings 50,000 square

feet and larger are undergoing the retro-commissioning process to optimize existing energy systems and improve energy performance.

Retro-commissioning (RCx) or Existing Building Commissioning is a process that identifies operational problems and repairs them rather than relying on major equipment replacement. The process involves a diagnostic monitoring and functional testing of building systems with the implementation of measures to capture energy savings. Each building will be re-commissioned every five years after initial retro-commissioning to take advantage of new energy technologies.

Thus far, 25 State RCx projects are at or near completion. The RCx projects completed to date are projected to achieve an average estimated savings of 10.6 percent in electricity consumption and 15.8 percent in natural gas use.

Energy Services Companies

Following EO S-20-04, DGS is establishing an energy services companies (ESCO) program to perform energy services performance contracts for State buildings. A performance contract is an agreement made between the State and an ESCO, in which an ESCO guarantees energy savings that are expected to result from the implementation of an energy project, such as installing new equipment, doors, and windows, or adding insulation. Performance contracts are an essential component of a comprehensive State energy efficiency program, as described in the Governor's Green Building Initiative. The State's primary energy efficiency investment goal is to capitalize on energy efficiency measure opportunities at each facility through equipment performance savings. Post implementation measurement and continuous monitoring of the energy systems will allow the project to automatically generate real-time mandated reports as required by EO S-20-04.

Locating State Facilities

State government needs to site its facilities in a manner that is consistent with the State’s planning priorities (Chapter 1016, Statutes of 2002) and the regional planning process outlined in the Scoping Plan. By locating its facilities in a way that promotes resource-efficient development and supports public transit, the state can enhance its partnership with local and regional governments in meeting the greenhouse gas reduction targets.

Future GHG Reduction Efforts

New Sacramento Central Heating and Cooling Plant in Sacramento

State and Consumer Services Agency and DGS are spearheading the greening efforts to build the new Central Plant according to LEED Gold certification. The new Central Plant will serve the heating and cooling needs of the State Capitol and 22 other State-owned buildings in downtown Sacramento’s Capitol Area when it is completed towards the end of 2010.

The new plant will have increased energy efficiency and a greatly reduced need for water. The new facility will have cooling towers for extracting heat from the buildings,

eliminating the need to use well water or to discharge water into the Sacramento River. The plant will also feature a 4.25 million gallon, thermal energy storage tank. With the tank in place, DGS will be able to produce reserves of chilled water during off-peak energy demand times. The new plant will reduce water use by 90 percent compared to the existing plant. Solar panels will also be installed on the new facility to power the energy needs of the office space within the plant.

California Utilities Join Forces to Save Energy In State Buildings

In its effort to significantly increase the level of energy efficiency in state-owned buildings, DGS is collaborating with Southern California Edison, Pacific Gas and Electric Company, San Diego Gas & Electric and Southern California Gas Company, to provide nearly $17 million in incentives for the implementation of energy-saving programs in State facilities. SMUD and other publicly owned utilities have also been strong allies in the State's efforts to cut GHGs.

Energy Efficiency Building Tools

DGS has developed a standardized building management manual, "*Better Building Management for a Better Tomorrow,*" for use in all DGS-managed buildings. The manual establishes green policies and procedures to ensure energy and resource-efficient practices are implemented and maintained. The manual is available to other State agencies and the general public as an example of a policy manual that meets the criteria of several LEED-EB credits requiring management policies.

In addition, Lawrence Berkeley Lab's EnergyIQ building benchmarking tool can also be used to benchmark government buildings and help determine their efficiency and potential for GHG emission reductions.

D. ENERGY PRODUCTION, PROCUREMENT, & NON-FACILITY USE

This section focuses on efforts to produce/purchase clean energy and to reduce non-facility energy use.

GHG Reduction Efforts

Clean Energy Production and Procurement

State agencies are working with energy suppliers to increase the procurement of energy from renewable sources such as solar, hydro-electric, and natural gas. Increased deployment of renewable resources is essential for reducing greenhouse gas emissions and reaching AB 32 goals. Over the last three decades, California has built one of the largest and most diverse renewable generation portfolios in the world. Currently, about 11 percent of the State's electricity is from renewable energy sources including solar, wind, geothermal, and biomass.

The Green Building Initiative (Executive Order S-20-04) tasks State government to demonstrate leadership in energy efficiency and environmental responsibility in State buildings, while also reducing their impact on climate change. In response, a number of State agencies have invested in solar energy projects. For instance, photovoltaic (PV) powered remote telecommunications, cathodic protection of bridges (using a low level electrical charge to retard the chemical decay/rust), and emergency call boxes have been in place since the late 1980s. The Department of Agriculture (local fairs and CalExpo) has implemented PV systems that generate more than 8 MW of power, and DGS has a number of projects underway (for more detail see Part C. Facilities).

Through these and many other efforts, 4.2 megawatts of clean, on-site solar energy has been installed at State-owned facilities since 2006, and more are on the way. An additional 23 megawatts of on-site solar energy are planned for installation at State prisons, mental hospitals and CSU campuses beginning in 2008. Stationary fuel cell applications are also being evaluated for State facilities.

Another effort is the DGS purchases of natural gas for large State government "non-core" users - those with meters that use more than 250,000 therms per year. The bulk of the gas used by these agencies is provided through the DGS contract, however, there is still some gas provided by the gas utilities. Currently, 8 agencies and almost all eligible UC and CSU campuses use about 200 million therms of natural gas annually. Approximately 60 percent of this natural gas goes to boiler use and 40 percent for on-site electricity co-generation. As the rules that penalize “departing load” (customers who elect to generate their own power in an effort to escape higher contracted electricity supply rates are currently charged a fee by the utility) will end over the next few years, there are already increasing signs of interest in co-generation projects which offer opportunities for increased efficiencies and clean energy production.

Efficient Energy Use and Conservation

The Governor's Executive Order (EO) S-20-04 requires State agencies to reduce grid-based energy purchases for state-owned buildings by 20 percent by 2015, through cost-effective efficiency measures and distributed generation technologies. In response, many State agencies have taken significant steps to achieve the needed reductions that can be transferred to other agencies. Many reductions achieved at State facilities are detailed in Part C. *Facilities* of this section.

The following is an example of energy conservation efforts undertaken by Caltrans:

- Traffic Signals - Statewide conversion of signals to energy efficient light emitting diode (LED) fixtures was completed in 2002. The next generation of higher efficiency LED signals are starting to replace units installed in the 1990’s.

- Roadway Lighting - “Points of Conflict” on State-owned roadways (Federal Interstate Highways, State Highways and roads) are lighted at intersections, on/off ramps, and points of merging and separation. Higher efficiency lighting, control, and location options are all under study to improve efficiencies and safety.

- Roadway Sign Lighting - Illumination of informational signage located over the roadway. Statewide deployment of high efficiency induction lighting systems are almost complete.

- Bridge and Tunnel - Lighting systems used on bridges and tunnels are being reviewed for energy use reductions.

- Bulk Green Energy Procurement - Savings as a direct result of buying bulk discount energy, leads to more clean energy purchasing and less coal generated electricity use.

If all conservation projects are found cost effective and fully implemented, 2004 data forecasts that Caltrans would:

- Reduce daytime and/or nighttime electrical grid loads.
- Save over 205 million kilowatt-hours in annual energy consumption.
- Payback project costs through savings in energy and maintenance costs.
- Save approximately $162 million in forecasted ten-year net present value (NPV) from implemented projects.

Caltrans is also engaged in efforts to improve inter-modal centers at ports, develop new pavement products like rubberized asphalt using old tires, reuse of old concrete on-site as base and sub-base fill rather than transporting it to a landfill, change wharf and pier piling treatments, manage storm water run-off, reduce herbicide use, increase use of native plantings to reduce water use, and fund field testing as part of a long term continuing quality improvement program.

Potential Future Efforts

State government should focus efforts on low-cost, high return energy conservation efforts. The supply of renewable energy should be increased through both production and procurement, including increasing solar and other distributed renewable generation capacity. State government will continue to pursue technologies that reduce the load on water pumps and other large electric motors, and increase compact fluorescent lighting (CFL) and LED lighting in parks, tunnels, bridges, parking, and roadways. For instance, Caltrans has targeted numerous PV projects to be funded by the Internal Revenue Service Clean Renewable Energy Bonds (CREB) program.

Encouraging appropriate State agencies to facilitate state and local government infrastructure improvements may yield energy savings beyond buildings, i.e. pumping water, traffic signals, and outdoor lighting. Funding and financial incentives should be sought for these infrastructure improvements and to increase the supply of clean renewable energy.

E. ENVIRONMENTALLY PREFERABLE PURCHASING

Environmentally preferable purchasing (EPP) focuses on using goods and services that have a reduced negative impact on human health and the environment compared to competing products. These products use fewer materials, water and energy, are produced locally, are reusable and/or recyclable, and require less end-of-life management. All of these attributes result in a reduced impact on the natural environment. With State government annually purchasing approximately $6 billion in goods and services, State buyers have a responsibility to promote EPP while providing quality products and excellent value, environmental benefits, and a solid market to suppliers.

GHG Reduction Efforts

State Law Requires EPP

California law (AB 498, Public Contract Code, sections 12400-12404) and Executive Orders (EO S-20-04, S-7-04, and S-3-04) requires DGS to promote and to increase EPP by coordinating with other agencies, creating training programs, and publishing an EPP Best Practices Manual. The State's new “Environmentally Preferable Purchasing Best Practices Manual” provides State purchasing officials with information on dozens of environmentally friendly products and services. It contains information outlining environmental guidelines for purchasing many common items. Additionally, the manual identifies ways to reduce waste in the office, shop, or facility; allows buyers to choose from numerous product categories; and identifies the impacts associated with the manufacture and purchase of numerous products and services.

Recycled Content Product Contracts

The State Agency Buy Recycled Campaign (SB 1106, PCC 12200-12217) is a joint effort between the California Integrated Waste Management Board (CIWMB) and DGS to implement State law requiring State agencies and the Legislature to purchase products with postconsumer recycled content. The Procurement Division at DGS has established contracts that offer recycled content products to assist agencies in meeting the mandate of ensuring a minimum of 50 percent of the dollars spent on products within 11 categories is spent on recycled products. Recycled content products are defined as having various quantities of postconsumer content.

Current Recycled Content and Green Contracts

- Open Office Panel Systems Contract: The new Open Office Panel Systems (modular cubicles) contract has raised the bar substantially by moving to a best value procurement contract that allows up to 40 percent of the scoring to be applied to environmentally preferable attributes. The contract requires the use of recycled content materials, energy efficient task lighting (additional points for LED task lighting), and reduced emissions of volatile organic compounds (VOCs). It also encourages manufacturers to eliminate certain hazardous substances from their products and to reduce solid waste through reusable and recyclable shipping and packaging materials.

- The California Lamp Contract: The California Lamp Contract is a mandatory low-mercury lamp contract for T-8, T-12, and compact fluorescent lamp purchases. The California Lamp Contract reduces mercury levels in fluorescent lamps to less than 5 milligrams per lamp and offers electronic ballasts to increase the efficiency of lighting fixtures. All three suppliers provide for the collection and responsible disposal of used lamps as part of their contracts.
- Recycled Latex Paint Contract: This contract provides paint in a wide variety of colors containing up to 50 percent postconsumer paint. Recycled latex paint reduces the solid waste stream by recovering extra paint that may otherwise require disposal as hazardous waste and it reduces the emission of VOCs.
- California Gold Sustainable Carpet Standard: The California Gold Sustainable Carpet Standard requires up to ten percent postconsumer material content in new carpet and the recycling of old carpet to divert the material from landfills. This comprehensive standard also reduces specified toxic compounds and VOCs. The California Gold Sustainable Carpet Standard will become the basis of a new national standard. LEED credits are available for the use of carpet meeting this standard.
- Personal Computer Goods Solicitation: The current DGS personal computer (PC) Goods solicitation requiring Electronic Product Environmental Assessment Tool (EPEAT) Silver or better for Desktops, Notebooks, Tablets and Monitors is scheduled to be awarded in June, 2008. The evaluation process awards additional points to products that are certified EPEAT Gold.
- Copy Paper Contract: The new paper contract requires all State agencies to purchase copy paper with a minimum of 30 percent postconsumer content. However, many agencies and departments use 50 – 100 percent postconsumer content copy paper, much of it produced without the use of chlorine compounds for bleaching. The Office of State Publishing uses postconsumer content paper and soy-based inks whenever possible. Janitorial paper products and paper bags with a minimum of thirty percent postconsumer content are also available.
- Vehicle Contract: California is revising the methodology for evaluating vehicle purchasing contract bids to comply with the mandates of AB 236, which requires DGS to consider GHG emissions and fuel efficiency in fleet purchases. Current specifications also restrict the use of chrome plating and lead wheel weights. Recycled motor oil and antifreeze are used to maintain state vehicles, and retreaded tires are used for trucks and heavy-duty vehicles.
- Disposable Food Service Supplies: California has mandated the elimination of polystyrene in all line items of this contract and will purchase bio-based alternatives.

Potential Future Efforts

State government will continue its leadership role by undertaking a thorough analysis of goods and services it uses, and developing strategies to ensure a system-wide application of product evaluation methodologies that consider carbon intensity in purchase decisions. These policies and practices should also extend to the contractors that provide State agencies with goods, services or consultation.

DGS Procurement may propose modifications to the vehicle and equipment bidding process to increase the variety of vehicles available for departments' needs. This is consistent with the need to consider total value, not just lowest bid, in procurement. For example, the cost of replacing tires that require frequent changing due to lower quality may outweigh any savings gained by accepting the lowest bid. Fewer tires purchased generally means fewer emissions through the entire product lifecycle, particularly as State agencies increase their efforts to calculate end-to-end emissions of its procurement and operations.

A related effort includes revising existing contract language to address GHG emissions, including the need to identify the carbon intensity of products, and to reduce emissions from the delivery to end-of-life management. Work is needed to research GHG values for other products to develop metrics and specifications to be included in bid documents. Those values could then be used to conduct a review of State government purchasing to identify the high priority products and services for GHG emissions reduction potential and establish a priority list of contracts to revise.

Ensuring that purchasing documents, specifications, and contracting procedures do not contradict each other and do not deter or inhibit the purchase of environmentally preferable products is an effort that will yield definite results. Once completed, designing and implementing programs and processes to increase the purchase of environmentally preferable products will be a much simpler task. Efforts such as restricting the purchase of single-sided printers and copiers, and requiring all State government documents to be printed duplex will be much easier to enact with clear direction and authority.

The development of an automated procurement tracking tool to be used by all State agencies for all purchasing that tracks EPP, and specifically GHG emissions will facilitate tracking and reporting progress. The tool should also enable contractors to report on the carbon footprint of their products, operations and supply chain, including a third-party certification of the data provided. This effort will need to be targeted first to the largest suppliers and then phased in to others over time.

California participated in the drafting of the Midwest Governor's Association's Bio-based Product Procurement Initiative and is currently working with the USDA to establish a national data base of bio-based products. These products will then become available on statewide contracts. Future contracts for industrial cleaning supplies will require that all catalog items identified as "green" be certified to acceptable standards by an independent third party. State agencies will be blocked from buying any non-certified

items where a comparable certified option is available, and regular and accurate reporting will be required on environmentally preferable purchases.

Efforts are underway to develop carbon labels for consumer products that will allow consumers to compare products by their carbon footprint. Also, the coolcalifornia.org carbon calculator will soon have a built-in decision-support tool that will help users estimate the change in their GHG footprint if they take specific actions. These efforts will help provide the raw data needed by buyers to track and report the emissions their purchases are responsible for.

F. EMPLOYEE PRACTICES

The initial carbon footprint audits conducted by a number of agencies have made it apparent that employees play a huge role in reducing GHG emissions. Choices regarding employee commutes, air and business travel, lodging, lighting use, and plug load all heavily impact energy use and the resulting GHG emissions. With employees having such an impact on these areas, all State agencies must involve employees in adopting policies to cut emissions and to conduct a consistent education and training effort.

GHG Reduction Efforts

GHG Emissions Audit

All the cabinet level State agencies, the CSU system and most UC campuses have joined the California Climate Action Registry (CCAR). By joining CCAR, they are obligated to prepare and submit annual GHG emissions inventories. CCAR registration establishes an emissions baseline and gives the agency a blueprint for future reduction efforts.

Environmental Management System (EMS)

An EMS is an integrated set of management processes designed to continually identify, prioritize, and improve the environmental impacts of an organization. An EMS integrates environmental management throughout daily operations, budget and human resource planning, and strategic planning. Cal/EPA has been involved in an agency-wide EMS since 2001. The EMS effort focuses on building-related operations and on the business processes and employee and stakeholder practices that relate to business operations. EMS is an excellent process to both institutionalize GHG reduction efforts and harness the power and influence of staff to maximize impact and achievement.

Agency-wide Policy Development

Many agencies have been actively involved in reducing energy use for years. With the recent push from AB 32, much effort and attention is again focused on the burning of fuel for various purposes causing GHG emissions. More information is available now about the development of baseline emissions from which reductions can be measured, as well as technological advancements and case studies. The quantity and quality of this information is increasing daily. Sharing the successes and case studies among all State

government is needed now so that all agencies can implement best practices to their fullest.

This flow of information within and among agencies can best be achieved by adopting policies. Policies are effective ways of communicating the same measure to a large number of people. They are especially effective in ensuring that efforts made by dedicated people are not lost over time as those employees move to other jobs or retire. Many agencies have policies already, while others like ARB's Carbon Neutral Policy are being drafted or considered.

Information Technology (IT) Efforts

IT equipment is one of the fastest growing segments of energy use in office buildings. Many efforts are under way to reduce energy consumption from IT equipment. For example, DGS has installed centralized server-based power management software that yields energy savings of thirty to forty percent. DMV and Caltrans have or are considering implementation of this software.

DMV's Desktop Support Unit developed an in-house energy management solution, using existing software programs designed to aggressively adjust computers to a more energy efficient mode when not in use. Since the initial implementation on nearly 3,000 computers, the initiative has reduced average monthly electricity consumption by more than 86,000 kWh, reduced average monthly greenhouse gas emissions by more than 53.5 metric tons and saved California taxpayers an average of more than $11,000 per month.

Implementation of the department's total inventory of more than 5,000 computers is nearly complete and, when fully implemented, will reduce the department's annual electricity consumption by more than 1,700,000 kWh, reduce annual greenhouse gas emissions by more than 1100 metric tons and save California's taxpayers more than $230,000 per year.

Caltrans estimates there are about 18,000 computers distributed statewide, and along with servers, printers, plotters, modems, hubs, fax machines, and attached devices (like hard drives, scanners, CD-ROM burners, etc.), consume from 27 to 35 million kWh/yr. "Energy Star" systems reduce energy consumption when units are not used for set periods of time. This reduction in operation may save up to forty percent of normal operational cost, although turning off equipment when it is not needed is still the best form of energy conservation.

Other Non – IT Energy Conservation Efforts

Simple conservation efforts such as turning off lights when not in use, including non-essential overhead lighting in day-lit areas, lighting in unoccupied rooms, equipment and storage areas reduces energy use. Turning off overhead lighting as appropriate and using task lighting if daylight is inadequate for workspaces, switching off decorative lighting, signage and other lighting inside and out (if not necessary for security and safety) are simple yet effective ways to reduce energy use. Security and safety lighting should be maintained at the lowest acceptable levels.

Techniques used to make efficient use of natural daylight include closing blinds and window coverings on all solar exposed windows during appropriate times of the day or when rooms are not in use to block direct sunlight which increases room temperature. When not in direct sunlight, open blinds and shades to reduce or eliminate the need for overhead lighting. After business hours, turn off monitors, printers, and other equipment except for essential equipment needed for after hours operation (e.g., e-mail, email servers, fax machines or other essential equipment). Some offices will need to leave personal computers on after hours for security reasons, however, they can be set to energy-saving modes.

Thermostats should not be set below 78 degrees F in summer unless such a temperature in a particular job or occupation may expose employees to a health and safety risk. It is also critical to keep windows and doors closed when HVAC systems are in use to prevent loss of conditioned indoor air to the outside and minimize use of portable electric devices (e.g., microwaves, toaster ovens, electric heaters, or personal fans). Employees should consider dressing in appropriate warm weather business attire.

Potential Future Efforts

Some State agencies have adopted policies that impact emissions but encouraging more agencies to adopt specific GHG emission reduction policies would increase and coordinate efforts statewide. This may be an opportunity to revitalize existing energy conservation policies as well, or to address other issues in a combined environmental protection policy or EMS with strong executive support and training. The policy should ensure employee orientation and training stresses energy and GHG emission reduction practices. EMS and LEED training should be provided where appropriate.

These policies should all promote telework and flex schedules to reduce commute miles. With such a high percentage of emissions emanating from employee commuting and travel, it is imperative to increase participation in these emission reduction strategies. A centralized information clearing houses for alternative transportation options in major State employment centers should also be maintained.

Agency policies will also be an appropriate place to discourage driving on short trips. Particularly in the downtown area where agencies are clustered together and on college and university campuses, staff should be encouraged to walk, bicycle or make use of electric carts on short trips. Agencies should provide bicycles and carts for these purposes and conduct surveys on there usefulness on various lengths of travel.

There are myriad efforts that agencies can undertake to reduce emissions. One such area is updating office equipment so that there are fewer devices and increased efficiency, e.g., multi-purpose printer/copier/faxes instead of 1 device for each purpose. An overall reduction of print jobs through reminders on printers and copiers and messages sent via email about reducing paper use with save both electricity and paper. Ensuring all new printers/copiers purchased are duplex capable and are defaulted to duplex, while a common practice by some, is not yet a universal statewide practice.

High parking costs can be an incentive to carpool or to use public transportation. It is recommended that DGS examine parking costs at State garages and compare them to local private lots. If rates charged to drivers are significantly lower, then the rates should be increased to discourage individual driving and reduce emissions. Parking subsidies for State employees should also be factored into this review as they reduce parking costs for individuals at an expense to agency budgets.

Perhaps the single most important action any agency can take is to conduct a GHG emission audit. While many agencies have conducted audits or registered with CCAR already, a concerted effort must be made to continue to encourage additional agencies to follow suit. It is imperative to establish a baseline to begin identifying priority areas to cut emissions and maximize efficiencies.

G. STATE GOVERNMENT'S CARBON SHADOW

The previous discussion has focused on specific actions that can reduce GHG emissions directly attributable to State government projects and operations (the traditional view of "carbon footprint"). The following discussion will briefly outline a strategy to leverage the capabilities of State government to influence GHG reductions by entities with which the state does business and which are affected by State policies and decisions. This has come to be referred to as State government's "carbon shadow".

A prime example of the influence the State can generate is as an investor. Through its two largest pension systems, the State has an investment portfolio in excess of $400 billion . These funds can be leveraged to support companies, programs, and projects that reduce GHG emissions. Public Employees Retirement System (PERS) and State Teachers Retirement System (STRS) should continue to examine their real estate portfolio for opportunities to increase energy savings, invest in energy efficient buildings, and/or devote a greater portion of the Clean Technology Investment Portfolio to advanced energy efficiency/green technologies.

Another GHG reduction opportunity for the State is in the use of bond funds. Ownership of the GHG emission reductions resulting from State bond funded projects will remain with the State. Those emission reductions should not be considered the property of the entity that received the bond funds, nor shall they be entitled to seek further financial gain from those reductions. Instead the GHG emissions reductions should belong to the State, and ultimately be used to promote the goals of AB 32.

The influence of State government's carbon shadow can also be exerted in the area of evaluating legislative bills, administrative directives, regulations, policies, projects, and programs, in terms of their impact on GHG emissions. State government must institutionalize the evaluation of GHG emissions as part of the review and approval process for all major funding requests and projects. This policy should be mirrored by local jurisdictions and the private sector, thereby ensuring that GHG emissions are factored into all major decisions and long range planning processes throughout the State.

Another shadow effect that the State can have is in the area of employee commutes. While not technically considered business travel, emissions related to employee commutes should be addressed by State government system wide. Agencies must take steps to further reduce commute emissions by increasing telecommuting and flex schedules to reduce the number of days employees need to travel to work. When coming into the office, employees should be rewarded for taking public transportation, carpooling, biking, or other means of reduced emission travel. These practices will also be picked up by local government and the private sector to amplify the influence of State government.

Green Insurance Policies for Homeowners and Commercial Businesses

The main features of "Green Buildings" are enhanced energy efficiency and reduced energy use. The most economical time to integrate these cost-effective green building features is either during new construction or when repairs are needed. While homeowners have been encouraged to consider rebuilding with green technologies after a loss, the State should encourage insurance companies to provide policies that would allow building owners to rebuild in the most environmentally beneficial manner.

There are currently several insurers offering this incremental insurance for both homeowners and commercial building owners. Some policies allow for rebuilding to the latest environmental efficiency standards, including recycled-content building materials, rapidly renewable and sustainably produced products, low VOC interior finish materials, and Energy Star lighting and appliances. Other policies are available for homeowners who generate their own power with solar, wind, or geothermal energy, and others for landscaping that reduces the cost of heating or cooling such as shade trees or wind-block vegetation.

For commercial building owners, an option is available allowing policyholders to rebuild an already-existing LEED certified building to the next highest level of LEED certification, or, if the building was not LEED certified, policyholders can rebuild to a LEED silver certification level. [23]

Through the increased use of these policies, the State can work with insurance companies and property owners to increase the number of energy efficient homes that have a lower carbon profile and reduced greenhouse gas emissions.

"Carbon Shadow" Contributions to a Green and Clean Economy

The ARB and numerous other State agencies are focused on green and clean practices, more informed policies and changed behaviors to save energy, convert to renewable and sustainable materials and fuels, all with an end in mind to reduce State government's carbon footprint. We expect these reductions will give a boost to the California economy, and are gearing up to meet the expected demand. State agencies are mustering their resources to address labor market and economic issues to prepare the workforce for

[23] http://www.reuters.com/article/pressRelease/idUS145859+03-Mar-2008+BW20080303

changing working conditions. With the passage of AB 3018[24], ARB will coordinate with the newly created Green Collar Jobs Council to develop a comprehensive array of programs, strategies, and resources to address the workforce needs in the emerging green economy. Following are some examples of current "Carbon Shadow" activities of State agencies that work intimately with the economic development, employment, and workforce preparation fields in California:

Studying the Green Economy

The **California Economic Strategy Panel** (ESP) is focusing on Green and Clean initiatives, and how they will impact the California economy. For more information, see their monograph *Clean Technology and the Green Economy* published in March 2008. http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf The ESP is sponsoring a series of regional forums throughout the state to gain further input on the impact of changes in the economy.

The **Employment Development Department**'s Labor Market Information Division (LMID) is working to define "Green" industries and occupations. Clear definitions will be essential to measuring the labor market effects and needs of a greener economy. There are many aspects of work that could be considered green, such as using new materials, methods, products, and services. However, we do not yet have a common language capturing the broad and varied nature of green industries and jobs. Several states and many local organizations are working collaboratively to better understand and promote the effects of clean and green technology on our economy. LMID is working with partners to survey the literature, analyze legislation, and track economic issues. See more at http://www.labormarketinfo.edd.ca.gov/?pageid=1032.

Workforce Training Programs

The **California Community Colleges** are strategically positioned to help California's businesses adapt to the green economy and to help students to connect with existing green collar jobs. The Colleges offer courses in Green or environmentally sensitive areas, and can adapt existing programs to meet industry need for Solar Panel Worker Certification and Utility Worker Certification. Programs range from 1 year Certificate, to 2-year Associate's Degree. To date, 40 colleges are offering courses, with plans to adapt existing programs in other colleges as well. Other courses are offered in Construction & Landscaping, Conservation and Ecology Management, Hazard Waste Management and Alternative Energy. More than 4000 degrees and certificates for these programs were conferred in 2006-7 alone. For more information on the Community Colleges programs, see http://www.cccco.edu/Home/tabid/189/Default.aspx.

In addition, the Community College **Centers of Excellence** have been conducting research, working with business and developing coursework related to solar and wind energy and green construction. To learn more, see http://cccewd.net/resource.cfm?c=27.

[24] AB 3018, (Nuñez, Chapter 312, Statutes of 2008)

The **California Workforce Investment Board** (State Board) recognizes that Green technology will impact the entire California economy. The State Board is addressing the current and future workforce needs in the green economy through an industry sector approach. Using information and data from the Economic Strategy Panel's Regional Economies Project, the Board's strategy will support and enhance local workforce board initiatives (see http://www.labormarketinfo.edd.ca.gov/contentpub/GreenDigest/WIB-CA-GreenInitiatives.pdf) that engage businesses in their areas in preparing workers for emerging job opportunities in the green economy.

The strategy will include, but is not limited to:

- Transformation roundtables featuring experts in Industry Cluster and Sector Strategy methodologies and Green Technology.
- The development of a repository of Clean and Green projects and career technical and educational programs that feature the latest green technology.
- A focused initiative designed to connect local and regional partnerships to multiple funding sources including grants, philanthropic organizations, funding collaboratives and the Governor's discretionary funds.

For more information about the California Workforce Investment Board, see http://www.calwia.org/.

Funding the Training and Retraining of Workers

In addition to the Workforce Investment Act funded activities of the **California Workforce Investment Board** and **local workforce investment boards** referenced in the prior section, the **Employment Training Panel** has given funding of training and retraining workers for new duties in the green economy a strategic focus. In support of the State's efforts to maintain a healthy environment and foster the emerging green sector, the ETP will continue to disperse training funds directly to employers and other entities to help workers acquire the skills demanded by occupations in the green economy. Since July 2006, the Panel has approved $26 million in 53 green/clean technology related contracts for more than 23,000 workers. For more information on the ETP, see http://www.etp.ca.gov/

Appendix C: State Government
Table 2

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
State Government	1-2	TBD	Various	TBD/Ongoing

3. THE ROLE OF LOCAL GOVERNMENT

Introduction

Local governments are essential partners in achieving California's greenhouse gas reduction goals. They have broad influence and, in some cases, exclusive authority over significant emission sources through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. In fact, many of the measures identified in the Scoping Plan rely on actions that local governments can take. These actions, outlined later in this section, demonstrate how local governments taking a sustainability approach to their decisions can greatly impact GHG emission reductions within their community and collectively, the state. In order to most effectively achieve the goals of AB 32, cities and counties statewide will need to actively engage in implementing Scoping Plan measures at the local level and undertake other emission reduction actions that make sense for each community.

Many local governments have already implemented programs to reduce greenhouse gas emissions. Over 120 California cities have signed on to the U.S. Conference of Mayors Climate Protection Agreement. In addition, over 30 California cities and counties have committed to developing and implementing Climate Action Plans. These communities have not only demonstrated leadership in taking initiative to reduce GHG emissions, they are also reaping important co-benefits, including local economic benefits, more sustainable communities, and improved quality of life. Lessons learned from these early efforts can help inform actions by other local governments going forward.

Comprehensive Local Approaches

ARB encourages cities and counties to develop a collaborative, comprehensive approach to reducing GHG emissions and address climate change within their own communities.

A local government's comprehensive approach to reducing GHG emissions can be included in their General Plan or take the form of a separate Climate Action Plan. For example, many local governments are incorporating appropriate climate objectives within each existing element of their general plan. This method may facilitate a more timely, comprehensive, and coordinated response. Key elements of any comprehensive plan addressing greenhouse gas emissions should include (1) development of municipal and community-level GHG emissions inventories, (2) adoption of local emissions reductions mechanisms and strategies that can be implemented through local plans, programs, codes and ordinances, (3) establishment of emission reduction goals and 4) development of an emissions reporting mechanism to track progress toward those goals.

To provide local governments guidance on how to inventory and report greenhouse gas emissions at both municipal and community level ARB will provide protocols for accurate measurement. ARB recently adopted the Local Government Operations Protocol which inventories emissions from government buildings, facilities, vehicles, wastewater and potable water treatment facilities, landfill and composting facilities, and

other governments operations. ARB is also developing an additional protocol for community wide emissions. This protocol will go beyond just municipal operations and include emissions from the community as a whole including residential and commercial energy consumption and transportation activity.

Once an accurate inventory has been established, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallels the State commitment to reduce greenhouse gas emissions by 15 percent from current levels by 2020.[25] Local governments that meet or exceed this level of reductions prior to 2020 should be properly recognized as discussed below. Early emission reduction actions taken by and fully accounted by jurisdictions should also be counted toward any reduction goals. To consolidate climate action resources and aid local governments in their emission reduction efforts, the ARB is developing various tools and guidance for use by local governments, including the next generation of best practices, case studies, a climate calculator, and other decision support tools.

As local governments assess the GHG impacts of their community, transportation-related emissions represent one component that should be evaluated at the local level and within the larger regional context. The relationship between GHG inventories at the local and regional level is complex and will be worked out during the protocol development process. Local governments should look to reduce local transportation related emission through local transit, parking policy, bike/walk infrastructure and other related programs. In addition to action at the local level, local governments should also work collaboratively with neighboring jurisdictions and the regional agencies, in the context of regional transportation planning efforts, to ensure regional transportation-related GHG reductions targets are met or exceeded.

In recognition of local achievements, the Institute for Local Governments (ILG) is developing a program to recognize local governments that take progressive action to reduce GHG emissions at the municipal and community scale. Part of that program is a goal-setting structure. Under its current draft form, local governments would be recognized as they achieve various performance standards with a gold level of 20 percent below current levels indicating the highest standard. A platinum level is also being considered for local governments whose actions result in emission reductions above and beyond these levels. In order to achieve recognition, local governments must prepare a baseline inventory, develop a climate action plan, implement climate actions in 10 opportunity areas, and report progress. ARB views this as an opportunity for local governments to showcase their leadership role as they pursue more aggressive reduction goals and is considering ways to provide additional considerations for State funding programs linked to performance

Table 3 provides an illustration of measures in the Scoping Plan in which local government plays a role to achieve greenhouse gas reductions.

[25] For the state this is approximately equivalent to a 30 percent reduction from projected 2020 levels.

Appendix C: Role of Local Government
Interaction of Local Government with Scoping Plan Measures

Table 3

Scoping Plan Measures	Potential Local Government Actions

Energy Efficiency	• Increase Utility Energy Efficiency Programs (either as municipal owners or partnership with local Utilities)
	• Reduce energy consumption and install solar water heating systems within local government owned/operated facilities and operations
	• Promote the following programs within the jurisdiction:
	  ○ Reduction in energy consumption through programs to promote better home insulation, solar water heating systems, and solar and geothermal heating/cooling systems in homes/businesses
	  ○ Incentives for building owners and developers to participate in "Million Solar Roofs" project for solar-electrical systems, which includes overall efficiency upgrades to eligible structures.

Renewable Portfolio Standard	• Achieve a minimum of 33 percent renewables portfolio standard for local government owned utilities.
Green Buildings	• Facilitate green building construction, renovation, operation and maintenance at local government owned/operated facilities. • Implement the State adopted green building code (effective 2010), and provide training to local architects, engineers and developers. • Site buildings close to public transportation and services, and providing amenities that encourage walking and cycling, offering further GHG reducing potential. • Promote (lead by example) by requiring all new buildings and new residential and commercial developments to exceed existing energy standards and meet nationally-recognized building sustainability standards, such as LEED Gold standards.

Scoping Plan Measures	Potential Local Government Actions
Recycling and Waste	• Control landfill methane emissions (for jurisdictions that own/operate landfills). • Adopt Zero Waste and Environmentally Preferable Purchasing policies. • Increase diversion from landfills (commercial and residential recycling and composting/purchase of compost).
High GWP Gases	• Ensure proper maintenance of fleet vehicles and prevent leakage of motor vehicle A/C refrigerants. • Ensure proper handling/disposal of waste refrigerants.
Sustainable Forests	• Encourage land-use decisions that conserve forest lands. • Promote urban forest projects (shading/energy co-benefits). • Make public investment to purchase and preserve forests and woodlands.
Water	• Improve municipal water system energy efficiency/usage. • Increase water recycling. • Reuse urban runoff.
Transportation	• Participate in regional blueprint planning efforts and in the development of sustainable communities and alternative planning strategies to achieve regional GHG goals. • Incorporate local transportation GHG reduction measures in General Plans including funding and promotion of local transit systems, bike/walk infrastructure, local parking policies, car sharing, etc.. • Promote employee transit incentive programs, including, telework, carpooling, and parking cash-out policies.
Vehicle Efficiency	• Properly inflate tires and practice routine fleet maintenance.

Comprehensive local programs will address all greenhouse gas emissions that occur within a local government's jurisdiction. These not only include local government operations as discussed above, but also apply to businesses, residences, local transportation activity, agricultural operations and various other industries. ARB encourages local governments to partner with special districts, such as school districts, transportation planning agencies and waste and water utilities that provide services within their jurisdictions. Among the areas that local governments can focus on include:

- *Municipal and Community Energy*. Local governments can influence the carbon content of energy provided to their community through municipal utility operations, as well as the amount of energy used by community businesses and residents through building codes, conservation programs and other mechanisms.

- *Municipal and Community Waste and Recycling.* Local governments can change the carbon footprint of their jurisdiction's waste and recycling operations through collection system adjustments and promoting waste prevention and recycling to community businesses and residents.

- *Municipal and Community Water and Wastewater Systems.* Local governments can support community-wide water conservation and reclamation program efforts.

- *Urban Greening and Urban Forests*. Local governments can reduce greenhouse gas emissions and provide additional benefits to communities through the creation, enhancement, and expansion of community green spaces that provide multiple benefits. Urban forests that are strategically and properly planned, planted, and maintained, can provide reductions in energy use through shading buildings, homes, streets, pedestrian walkways, and densely-developed urban cores; thereby reducing surface and ambient temperatures and requiring less energy to cool.

- *Community Transportation*. Local governments can directly influence the local transportation planning processes to increase the use of low carbon travel such as transit, bicycling, walking and carpooling. They can also partner with regional planning agencies to create a sustainable vision for the future that accommodates population growth in a carbon efficient way. The recent passage and signing of SB 375 (Steinberg, Chapter 728, Statutes of 2008) creates a process whereby regions work to integrate development patterns, the transportation network and other transportation measures and policies to achieve GHG emission reductions. The implementation of regional transportation-related GHG emission targets and SB 375 are discussed in more detail in the transportation sector in this appendix.

- *Community Design.* Local governments have the ability to directly influence both the siting and design of new residential and commercial developments in a way that reduces GHG associated with energy, water, waste, and vehicle travel, which may include zoning for more compact and mixed-use residential and commercial development and adopting policies to promote infill and affordable housing.

Supporting Local Action

State, regional, local, and non-governmental stakeholders must work together to prioritize and create policies, programs, incentives, guidance, and funding to assist local actions to help meet the State's climate change goals. These will be developed on an ongoing basis. Currently, there are many supporting agencies and programs available to assist local governments in their efforts to reduce greenhouse gases. Guidance to measure community GHG emissions and resources for best practices continue to be developed and are being refined. Here are just two examples:

- In partnership with the ARB, California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry have developed a Municipal Operations Protocol and are developing a Community Level Protocol to provide a standardized set of guidelines to assist local governments in quantifying and reporting greenhouse gas emissions associated with their community.

- The California Climate Action Network, created by the Institute for Local Government, has developed a best practices framework that offers suggestions for local action in 10 opportunity areas, including energy efficiency, water and wastewater systems, waste reduction and recycling, and efficient transportation, land use and community design. They are also working with local governments and the ARB, among others, to establish a climate leadership recognition program that encourages support for local efforts and acknowledgement of successful programs.

Because ARB recognized early that many of the proposed measures to reduce GHG emissions rely on local government actions, ARB identified Early Action measures to develop tools in support of local government. ARB will continue to work closely with local agencies to encourage and provide tools for the active involvement of all cities and counties in the effort to reduce greenhouse gases and ensure a sustainable future. To consolidate climate action resources and aid local governments in their emission reduction efforts, the ARB is developing various tools and guidance for use by local governments, including the next generation of best practices, case studies, a climate calculator, and other decision support tools. ARB will also work to help identify resource needs and funding opportunities for local governments to undertake these efforts. As outlined in AB 32 Section 38565, a priority of ARB is for public and private investment to be directed to the most disadvantaged communities, and that small businesses, schools and other community institutions are able to participate in and benefit from statewide efforts to reduce greenhouse gas emissions.

4. TRANSPORTATION

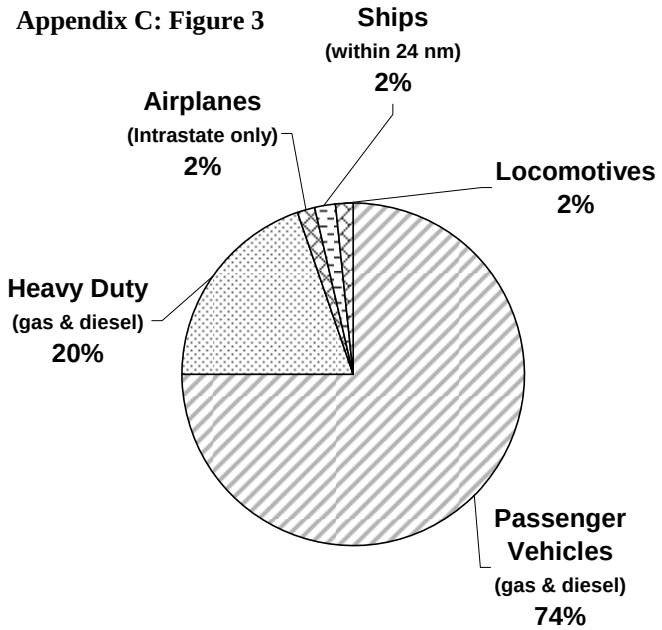
This section includes the following measures:

<u>Recommended Actions</u>
California Cap-and-Trade Program Linked to the Western Climate Initiative
(T-1) Pavley I and Pavley II– Light-Duty Vehicle GHG Standards
(T-4) Vehicle Efficiency Measures
(T-2) Low Carbon Fuel Standard (Discrete Early Action)
(T-5) Ship Electrification at Ports (Discrete Early Action)
(T-6) Goods Movement Efficiency Measures
(T-7) Heavy-Duty Vehicle GHG Emission Reduction—Aerodynamic Efficiency (Discrete Early Action)
(T-8) Medium- and Heavy-Duty Vehicle Hybridization
(T-3) Regional Transportation-Related Greenhouse Gas Targets
(T-9) High Speed Rail

Overview

The transportation sector is integral to the people and economy of California. California has a long, successful history of improving the environmental footprint of transportation-related activities. These efforts have resulted in significant reductions of criteria and toxic air pollutants, improved air quality and public health. In addition, the clean vehicle technologies developed in response to California regulatory efforts have provided benefits across the nation and throughout the world. To achieve our GHG emission reduction goals, it is vital that we build on our past successes in reducing criteria and toxic air pollutants to achieve significant reductions in GHG emissions from transportation and goods movement activities. GHG emission reductions will come from three overarching strategies: more efficient vehicles, lower-carbon fuels, and reduction of vehicle use or vehicle miles traveled (VMT). The GHG emission reductions in this sector will be achieved through regulations, market mechanisms, incentives, and land use policy.

Appendix C: Figure 3



Transportation activities are responsible for 38 percent of the greenhouse gas (GHG) emissions in California – or 182 $MMTCO_2E$ (2004). Because of its size, it is critical that the transportation sector achieve significant emission reductions toward the State's 2020 goal. If the transportation sector does not provide significant GHG reductions, it would be difficult

for another sector to make up the emission reductions. These reductions in GHG emissions can be achieved through the use of currently available and emerging technologies and behavior change.

Vehicles

Passenger vehicles (cars and light trucks) are responsible for 74 percent of the emissions from the transportation sector and are the primary focus of reduction strategies for the transportation sector. The Pavley (AB 1493) regulation, which has already been adopted by ARB, requires GHG emission reductions from passenger cars and light trucks. This regulation will provide about 27 $MMTCO_2E$ reductions in 2020—an 18 percent fleet wide reduction. The State of California is currently challenging a U.S. EPA decision that prevents the implementation of this regulation. Although ARB is confident that California will prevail, staff is also pursuing additional strategies to ensure that new California vehicles achieve the maximum feasible and cost-effective reductions in GHG emissions as required by law.

Although the Pavley regulation results in significant GHG reductions, more is needed. ARB is proposing additional strategies to ensure that new California vehicles achieve the maximum feasible and cost-effective reductions in GHG emissions including strengthening GHG tailpipe emission standards from passenger cars and light trucks and improving overall vehicle efficiencies.

Medium- and heavy-duty trucks account for about 20 percent of the transportation GHG emissions. ARB is pursuing strategies to increase the efficiency of medium- and heavy-duty vehicles through both engine specifications and devices that reduce aerodynamic drag and rolling resistance. These strategies will improve vehicle efficiency and reduce GHG emissions.

Fuel

The fuel used in cars and trucks also has a significant impact on emissions. ARB is currently developing a comprehensive regulatory proposal for the Low Carbon Fuel Standard (LCFS), which the Board will consider in late March 2009. It is anticipated that the proposed regulation will provide a 10 percent reduction in carbon intensity by 2020, which translates to approximately 15 $MMTCO_2E$ of emission reductions. Furthermore, ARB and WCI plan to include transportation fuels in the cap and trade program in 2015.

Jet fuel used in intrastate plane trips accounts for approximately 2 percent of California's GHG emissions[26]. Emissions from the fuel used in planes is an important consideration, however, the State does not have regulatory authority over aviation. ARB has not identified aviation specific measures; nevertheless, successful deployment of High Speed Rail could divert some air passengers to rail.

[26] These emissions do not include interstate air travel.

Vehicle Use

The other factor in GHG emissions from transportation is the use of the vehicle. In the case of passenger vehicles, the metric for use is most commonly referred to as vehicle miles traveled (VMT). Statewide VMT increased about 35 percent from 1990 to 2007, and with current trends is expected to increase another 20 percent by 2020 and more than double between now and 2040. For California to meet its long term GHG emission reduction goal, this trend must be slowed.

The key to addressing the VMT challenge is providing people with more choices through diversified land use patterns, greater access to alternative forms of transportation including transit, biking and walking, and promoting development patterns where people can live work and play without having to drive great distances. Altering land use patterns to bring people closer to more destinations and enhance transit can result in VMT reduction over the long term. Current regional planning efforts are starting to move in a direction to create the choices that are needed to reverse projected VMT growth. A strategy of coordinated State, regional, and local land use and transportation planning, policies and finance, must be developed to encourage reductions in VMT. Land use strategies that provide for more compact growth not only reduce VMT, but can also reduce the carbon footprint of developments by reducing land consumption, energy use, water use, and waste. While these strategies are likely to provide modest reductions in GHG emissions by 2020 because of the time required to change land use patterns, they are a central element in ensuring that California gets on a low-carbon trajectory as we get to and beyond 2020.

Goods Movement

A significant portion of transportation activities are associated with the movement of freight or goods throughout the State. Reducing GHG emissions from the vehicles and equipment used in goods movement activities through increasing efficiency of the way goods move throughout the State and other measures has the benefit of not only reducing GHG emissions, but also emissions of smog precursors and air toxics. With traffic at California ports projected to increase by 250 percent by 2020, reducing GHG emissions from this sector will be necessary to help meet the State's 2020 GHG goal. Proposed measures include implementation of two already adopted regulations for port drayage trucks and the use of shore power for ships at berth, and several new measures designed to improve the overall efficiency of goods movement throughout California, reduce fuel consumption, improve operational efficiencies such as improvements in dock-side container handling procedures, transportation mode shifts, and the application of new technologies and alternative fuels. Proposition 1B funds, as well as clean air plans being implemented by California's ports, will also help reduce greenhouse gases while cutting criteria pollutant and toxic diesel emissions. California's goal for the long-term is to identify and develop programs that will help bring the State closer to the 2050 target. Bringing the goods movement system to a low- or zero-carbon future will require California to begin work now on fostering the development of cutting edge low carbon technologies, creating partnerships to improve the overall efficiency of the goods movement infrastructure, implementing programs to leverage the consumer in promoting

a greener goods movement system, and identifying and implementing public policies that promote a low-carbon goods movement system.

Conclusion

California has the opportunity to lead the nation in reducing emissions from the transportation sector. While the further deployment of existing technologies will allow California to achieve the 2020 goal, meeting California's long-term GHG goals will require substantial reductions from all areas including lower GHG vehicle/fuel systems, increased transportation efficiency, changes in the delivery of goods and services, expanded transit, and more efficient land use patterns.

Recommended Actions

Cap-and-Trade Program

California is working closely with other states and provinces in the Western Climate Initiative (WCI) to design a regional cap-and-trade program that can deliver GHG reductions throughout the region. ARB will develop a cap-and-trade program for California that will link with the programs in the other WCI Partner states and provinces to create this regional market.

WCI has made a decision to include transportation fuels in the cap-and-trade program in 2015. WCI and California are assessing potential points of regulation for including transportation fuels in the cap-and-trade program. WCI's work to date has identified the point at which transportation fuels enter into commerce in each state and province as a candidate point of regulation. In California, this point of regulation could be at the terminal rack or the point of final blending. By setting an overall limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program will complement other regulatory measures for transportation fuels and achieve additional reductions in greenhouse gases in this sector.

A. LIGHT DUTY VEHICLES

(T-1) Pavley I and Pavley II– Light-Duty Vehicle GHG Standards

AB 1493 (Pavley), Health and Safety Code Section 43018.5, directed the Air Resources Board (ARB) to adopt a regulation requiring the maximum feasible and cost effective reduction of greenhouse gas (GHG) emissions from new passenger vehicles.

In September 2004, the ARB approved regulations to reduce GHG emissions from new passenger vehicles. The regulations apply to new passenger vehicles and light-duty trucks beginning with the 2009 model year and phased-in through the 2016 model year. These regulations add four GHG air contaminants to the vehicular criteria and toxic air contaminant emissions that California was already regulating – carbon dioxide (CO_2),

methane (CH4), nitrous oxide (N_2O), and hydrofluorocarbons (air conditioner refrigerants). The rulemaking established a declining fleet average standard for these pollutants, with separate standards for the lighter and heavier portions of the passenger vehicle fleet. The regulations also provide alternative compliance methods including credit generation from alternatively-fueled vehicles, and averaging, banking, and trading of credits within and among manufacturers.

The technical modifications needed to meet the standards will increase the cost of new vehicles. However, because these technology improvements will also reduce the operating cost of the vehicles, staff estimates that the average consumer will ultimately save $30 per month.

Under the Clean Air Act, California is required to apply for a waiver before implementing vehicle tailpipe emission standards. ARB applied for a waiver and was denied by the U.S. EPA. California and other states have challenged this ruling in court and expect to prevail. Nevertheless, AB 32 specifically states (section 38590) that if the Pavley (AB 1493) regulations do not stay in effect, the State shall implement alternative regulations to control mobile sources to achieve equivalent or greater GHG reductions. ARB currently plans to pursue a Feebate regulation to backstop the Pavley regulations if they cannot be implemented.

A Feebate proposal would require fees on the purchase of high GHG emitting vehicles that would then be returned as rebates to buyers of low GHG emitting vehicles. The fee schedule would need to be designed to obtain cumulative emission reductions equivalent to those that would have been achieved under the Pavley regulations. A more detailed description of this measure is in the next section.

In addition to Pavley I, ARB proposes to further strengthen the vehicle tailpipe emission standards beginning with the 2017 model year. The new standards will follow up on the existing standards that reach maximum stringency in 2016. The technologies that might be employed include highly efficient hybrid vehicles, use of lightweight materials to reduce vehicle mass, and reductions in air conditioning-related emissions through the use of low-GWP refrigerants or other approaches.

It is anticipated that there will be other benefits associated with Pavley I and the proposed Pavley II measures, such as a reduction in criteria pollutants. The regulations will reduce “upstream” smog-forming emissions from refining, marketing, and distribution of fuel.

Zero Emission Vehicles

The ZEV program plays a critical role in meeting California’s greenhouse gas reduction goals of 2020 and 2050. The ZEV program drives research, development, and deployment of zero emission vehicles. It also encourages advanced technology commercialization through introduction of ZEV enabling technology. In the near term, the ZEV program requires placement of hundreds of ZEVs in order to meet emission reduction goals. In the long-term, the ZEV program goals mandate the placement of

thousands of ZEVs and near-zero emission vehicles (plug-in hybrids, conventional hybrids, compressed natural gas vehicles, and clean gasoline vehicles) in California.

Zero emission hydrogen fuel cell vehicles will also play a critical role in both California's greenhouse gas reduction goals and ZEV mandate. The California Hydrogen Highway Network is an initiative established to support commercialization of hydrogen vehicles by promoting the development of fueling infrastructure in areas where vehicles are being placed. The Environmental Standards for Hydrogen Fuel Act (SB1505), passed in 2006, requires that as the hydrogen fueling infrastructure in California grows, greenhouse gas emissions associated with hydrogen production, delivery and use will continue to be less than well-to-wheel emissions from conventional gasoline vehicles.

The current ZEV program (planned until 2014) requires 22 automakers to produce the cleanest cars and deliver them for sale in California. In 2009, the Board will consider a proposal that is currently being developed to ensure that the ZEV program is optimally designed to help the state meet its 2020 target and put us on the path to meeting our 2050 target of an 80 percent greenhouse gas reduction.

Alternative and Renewable Fuel and Vehicle Technology Program

Under AB 118, ARB is administering the Air Quality Improvement Program (AQIP) to provide $50 million per year in funding for clean vehicle/equipment projects and research on the air quality impacts of alternative fuels and advanced technology vehicles. ARB's program is required to reduce emissions of criteria pollutants by the enabling legislation. However, advanced technologies funded by AQIP, including those that promote fuel efficiency, may also achieve reductions in GHG emissions.

AB 118 also created the Alternative and Renewable Fuel and Vehicle Technology Program and authorized the California Energy Commission (CEC) to spend approximately up to $120 million per year for over seven years (from 2008-2015) to develop, demonstrate, and deploy innovative technologies to transform California's fuel and vehicle types. This will assist the State in meeting its alternative fuel use and petroleum reduction goals in a manner consistent with the State's climate change and air quality objectives. CEC published a draft Investment Plan in July 2008 for the first and second year of funding. The proposed focus of the first year is:

- Support incentive programs to purchase and deploy alternative and renewable fueled vehicles,
- Incent production of low-carbon alternative and renewable fuels, and
- Implement a public outreach campaign to highlight the availability and benefits of alternative and renewable fuel vehicle options.

The proposed focus of the second year is:

- Develop an incentive program to retrofit light-, medium-, and heavy-duty vehicles with ARB-certified equipment,
- Support competition for advancement of alternative and renewable fuel vehicles,
- Support development and commercialization of lower-cost technologies to produce fuel at in-state facilities from waste feed stocks,

- Provide incentives for installation of new alternative fuel dispensing facilities,
- Support development of science curriculum about alternatives and renewable fuels and vehicles, and
- Implement a program with new car dealers to encourage delivery and sale of alternative and renewable fuel vehicles.

The AB 118 program creates the opportunities for investment in technologies and fuels that will help meet the Low-Carbon Fuel Standard, AB 1007 goal of increasing alternative fuels, AB 32 goal of reducing GHG emissions to 1990 levels by 2020, and the State's overall goal of reducing GHGs 80 percent below 1990 levels by 2050. ARB is coordinating closely with the CEC in the implementation of AB 118; participating as a member of the CEC's advisory committee, as well as providing technical assistance on air quality issues and to ensure that their alternative fuels programs work in concert with ARB's LCFS.

Appendix C: Transportation
Table 4

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Pavley (AB 1493)	31.7	-10,009	ARB	2004/2009-2016*
Pavley II – Light-Duty Vehicle GHG Standards		-1,049	ARB	2010/2017

* This regulation has already been adopted. Implementation of the regulation is pending the outcome of the legal challenge to the waiver denial.
†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

Feebates—In lieu of Pavley regulations

AB 32 specifically states that if the Pavley regulations do not remain in effect, ARB shall implement alternative regulations to control mobile sources to achieve equivalent or greater greenhouse gas reductions (HSC §38590). As part of the regulatory process, ARB is commissioning a study to analyze the implementation of Feebates in California both in place of and in addition to the Pavley standards. The study will assess elements of program design including fee and rebate levels, point of regulation, implementation strategy, consumer response, and interaction with other AB32 programs. If California were to be ultimately prevented from implementing the Pavley regulations, an aggressive Feebate schedule could be implemented to achieve equivalent or greater cumulative reductions that would have occurred under the Pavley regulations. In 2020, a Feebate

program advanced in the absence of the Pavley regulation would translate to equivalent Pavley reductions of 31.7 $MMTCO_2E$. If U.S. EPA grants a waiver for the Pavley regulation during the Feebate rulemaking process, ARB will evaluate the effectiveness and necessity of continuing with a complimentary Feebate program.

A Feebate regulation would combine a rebate program for low emitting vehicles with a fee program for high emitting vehicles. A vehicle would be determined to be low or high emitting in relation to a GHG emissions benchmark. The GHG emissions benchmark could take into account criteria beyond GHG emissions. Criteria such as gross vehicle weight (GVW), size of vehicle, or seating capacity could all factor into the calculation of a GHG emissions standard. Further, there could be multiple emissions benchmarks to account for different vehicle classes. The magnitude of the fee or rebate assigned to a vehicle would be determined by the difference between the GHG emissions of the vehicle and the applicable GHG emissions benchmark. In other words, a vehicle that is low emitting, relative to the GHG emissions benchmark, would receive a rebate, making it more affordable, and a vehicle which is high emitting, relative to the GHG emissions benchmark, would be charged a fee, making it more expensive. The program could include a limit on the maximum fee or rebate assigned to any vehicle. The schedule of fees and rebates and the maximum fee or rebate will be determined through the public process.

The Feebate program would advance the production and adoption of low-emission vehicles and cleaner technologies. Feebates would make low-emission vehicles more affordable. Vehicle manufacturers would include cleaner technologies in their new fleets to take advantage of the rebates offered to low-emission vehicles. At the same time, the rebates would make low-emission vehicles more attractive to new vehicle buyers. The majority of emissions benefits would stem from improvements in the vehicles themselves with minimal impacts on the range or volume of vehicles available for purchase.

The Feebate program would have an immediate and cumulative effect on GHG emissions from new vehicles. Both GHG and criteria pollutant benefits would be expected as cleaner technologies enter the passenger vehicle and truck fleet. As the existing vehicle stock turns over and auto manufacturers respond to the Feebate program by marketing cleaner and more efficient technologies, the GHG and criteria pollutant reductions would grow.

The Feebate program would be self-financing, with a small portion of the revenue generated from the program going to its administration. From year to year the program may generate a net loss due to a greater than expected demand for rebated vehicles or generate a net surplus due to a greater than expected demand for vehicles that carry a fee. Over the life of the program, ARB would adjust the fee and rebate schedules by modifying the GHG emissions benchmark to compensate the program for losses or surpluses generated. However, the level of the emissions benchmark will not determine the total emission reductions as much as the fee (or rebate) for each additional gram of GHG emitted (or avoided) per mile.

Appendix C: Transportation
Table 5

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Feebates (In lieu of Pavley regulations)	31.7	0	ARB	Pending legal challenge

(T-4) Vehicle Efficiency Measures

Several measures would further reduce tailpipe GHG emissions by increasing vehicle efficiency. These measures include: ensuring proper tire inflation and adopting a low rolling resistance tire standard, use of low friction engine oils, and solar-reflective automotive paint and window glazing. ARB identified the tire inflation measure as a Discrete Early Action in 2007, which means a regulation to implement the measure, must be enforceable starting in 2010.

Tires

A properly inflated tire helps to reduce fuel GHG emissions by reducing tire rolling resistance. Low rolling resistance tires for passenger and light duty vehicles can result in a 1 to 2 percent reduction in GHGs. The tire inflation and tire program would affect vehicle service facilities such as dealerships, maintenance garages, oil change facilities, tire centers, and smog check facilities. For the tire inflation program, it is clear that not all vehicles are serviced at regular intervals and that many individuals maintain or service their own vehicles, therefore, public education about proper tire inflation is also necessary. For the tire tread program, a two-phased approach is needed, beginning with data gathering and education, followed by the development and adoption of tire rolling resistance standards.

Low Friction Engine Oils

Engine oil formulations can also impact a vehicle's GHG emissions, because the more easily the internal parts of the engine move, the more efficiently the engine will run. This, in turn, reduces the engine load and fuel used. Requiring passenger cars to use low friction engine oils can result in a 2 percent GHG reduction. Entities that could be affected by the low friction engine oils measure, depending on the point of regulation, include lube oil manufacturers, automobile manufacturers, and auto-repair shops.

Solar-Reflective Automotive Paint and Window Glazing

The use of solar-reflective automotive paint and window glazing would reduce the solar heat gain in a vehicle parked in the sun. Solar-reflective automotive paints are formulated with pigments that have low absorption (high reflectance) of sunlight. The more solar energy is reflected from a vehicle, the less the vehicle's interior will heat up when it is parked in the sun. A cooler interior would require less air conditioner use, which improves vehicle efficiency. Also, because the trend over time has been towards increased glass in vehicles, this measure would likely include a requirement that window glazing also meets certain solar reflectivity requirements. The solar heat gain reductions

that can be accomplished with reflective glazing are even more substantial than those that can be obtained with solar-reflective automotive paints. The affected entities for this measure would be the vehicle manufacturers, paint vendors and manufacturers, and window/window film suppliers.

Appendix C: Transportation
Table 6

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Tire Pressure Program*	0.55	-72	ARB	2009/2010
Tire Tread Standard	0.3	-123	CEC	2009-2010?
Low Friction Engine Oils	2.8	-630	ARB	Pending
Solar-Reflective Automotive Paint and Window Glazing	0.89	-5.7	ARB	2009/2012
Total:	4.5			

*Discrete Early Action, to be enforced beginning on January 1, 2010.
†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

B. FUELS

(T-2) Low Carbon Fuel Standard (Discrete Early Action)

In January 2007, Governor Schwarzenegger issued an Executive Order (S-01-07) establishing a Low Carbon Fuel Standard (LCFS). ARB approved the LCFS as a discrete early action measure and is set to adopt the regulation in March 2009, with implementation beginning in 2010. With close to 16 billion gallons of gasoline and approximately 4 billion gallons of diesel sold per year, sales of petroleum-based fuels make up approximately 96 percent of all transportation fuel sold in California. The LCFS is a key part of the State's strategy to reduce GHG emissions from the transportation sector and is being developed to reduce the carbon intensity of the State's transportation fuels by at least 10 percent by 2020.

The LCFS would require fuel providers[27] in California to ensure that the mix of fuel they sell into the California market meets, on average, a declining standard for GHG emissions measured in carbon dioxide equivalent grams per energy unit[28] of fuel sold.

[27] The LCFS would apply to all transportation fuel providers, including: refiners, blenders, producers or importers of transportation fuels in California and applies to providers of gasoline, diesel, natural gas, LPG (propane), electricity, hydrogen, ethanol, biodiesel and other mixed blends.
[28] Units expressed are grams of CO_2 equivalent per mega joule (gCO_2E/MJ).

Fuels used for both on-road and off-road consumption would be covered. However, the LCFS would not apply to certain aviation and marine fuels that ARB lacks the authority to regulate.

Transportation fuels would be evaluated and assigned carbon intensity values measured on a full fuel cycle basis. This full-fuel cycle assessment would include the direct emissions from resource extraction (or production), transportation, refining/distillation and distribution. In addition, indirect land use GHG emissions would also be calculated and assigned where appropriate. For example, GHG impacts would be estimated from changes in land use patterns (i.e., converting forest lands to farms in South America).

Reducing the aggregate carbon intensity of fuels may be achieved through flexible compliance mechanisms whereby providers exceeding the required performance standard would receive credits that may be applied to future obligations or traded with providers not meeting the LCFS. Declining carbon intensity standards would be determined separately for gasoline and diesel.

It is currently proposed that regulated parties may meet the standard by various means, including: 1) providing only fuels that meet the standard; 2) providing a mix of higher and lower carbon fuels that on average meet the standard; 3) using previously banked credits in an amount that equals the credit deficit; and 4) acquiring credits from other parties who earned credits by exceeding the standard such that the amount of credits acquired equals the credit deficit. For example, a producer may choose to meet the LCFS by a combination of selling low carbon fuels (e.g., ethanol derived from waste resources), and by buying credits from other LCFS regulated parties.

Utilizing flexible compliance mechanisms would allow fuel providers flexibility to choose how they reduce emissions and realize GHG reductions at the lowest cost and in the most consumer-responsive manner. For example, providers could purchase and blend more low-carbon ethanol into gasoline products, purchase credits from electric utilities supplying low-carbon electrons to electric passenger vehicles, diversify into low-carbon hydrogen as a product, and employ other new strategies yet to be developed.

The LCFS should result in several co-benefits, including bringing about meaningful changes in the fuels market by giving low carbon fuels a market edge over high carbon fuels. The LCFS should spark research in alternatives to petroleum-based fuels, leading to GHG emission reductions over the long term. This may provide important benefits as the state diversifies its fuel mix and becomes less dependent on petroleum.

ARB is performing a complete environmental analysis of LCFS during the regulatory process. In addition, ARB is evaluating potential localized impacts associated with the LCFS, as well as, various sustainability issues. Fuels, such as natural gas, liquefied petroleum gas (LPG), electricity, and hydrogen, would contribute to the LCFS by displacing some gasoline and diesel fuel. To the extent that such displacement occurs, vehicles operated with these fuels are likely to have lower criteria and toxic emissions.

There will be additional costs associated with the development of new alternative fuels such as the production of ethanol from cellulosic feedstock or the production of biodiesel or renewable diesel from various biomass-related feedstocks. Moreover, there will be added costs associated with infrastructure needs. However, the costs of producing these fuels, given the current cost of gasoline and diesel production, are expected to be highly competitive. Therefore, ARB estimates that there will be no net difference in the costs of producing fuels to meet the LCFS versus the cost of producing gasoline and diesel.

The LCFS is scheduled to be presented to the Board in the March 2009 timeframe with full implementation starting in 2010.

Appendix C: Transportation
Table 7

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Low Carbon Fuel Standard (Discrete Early Action)	15	0	ARB	2009/2010

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

C. GOODS MOVEMENT

In October 2007, ARB approved three early action measures that affected goods movement activities. One of these, ship electrification at ports, was a discrete early action and the other, the Port Drayage Truck rule, was an early action measure. The Board adopted these two measures in December 2007. The third, Vessel Speed Reduction, is currently under development. These three, and several new measures, being proposed for consideration in the Scoping Plan are described below.

(T-5) Ship Electrification at Ports (Discrete Early Action)

In December 2007, ARB adopted the shore power regulation, a Discrete Early Action measure enforceable starting in 2010. This regulation requires most container, passenger, and refrigerated cargo ships to shut off their auxiliary engines while at dock and receive power from the electrical grid, or reduce their emissions by a similar amount via the implementation of other technologies.

(T-6) Goods Movement Efficiency Measures

There are many opportunities to reduce GHG emissions from goods movement. Efficiency improvements can be implemented for the equipment or vehicles that transport goods at facilities such as ports, intermodal rail yards, and distribution centers. More broadly, there are likely opportunities to improve the overall efficiency of how goods are transported to, through, and within California. Several new strategies are proposed for evaluation and consideration that will reduce GHG emissions from goods movement activities. These strategies include near-term measures that rely on available low carbon technologies and operational efficiencies and longer-term measures that will help bring California closer to the 2050 emission reduction target by promoting a low carbon and sustainable goods movement system. These strategies, which are being combined under measure T-6, are briefly described below.

Overall, the emission reduction goal for measure T-6 is to achieve a combined 3.5 $MMTCO_2E$ reduction in GHG emissions by 2020. This represents about a 20 percent reduction in the projected 2020 GHG emissions from this sector. Because of the complexity of this sector and the need for a thorough investigation of a variety of approaches to determine how best to improve goods movement efficiency, ARB has assigned an overall emission reduction goal for the goods movement sector to assist with meeting the AB32 emission reduction target rather than assigning emission reduction targets to individual measures. Furthermore, it is conceivable, that in addition to the strategies outlined below, new ideas and approaches will be identified through our public process that can be implemented to meet or exceed the targeted 3.5 $MMTCO_2E$ reduction in GHG emissions.

Goods Movement System-Wide Efficiency Improvements

Under this proposed measure, California ports, railroad operators, shipping companies, terminal operators, ship owners/operators, importers, exporters, trucking companies serving ports and rail operation, government agencies, and the public would participate in developing and implementing programs to achieve system-wide reductions in GHG emissions from goods movement activities. These programs would be in addition to existing measures for goods movement sources, and would be developed over time through a public process. In many cases, these programs would involve innovative, incentive based approaches, or unique strategies specific to a company, port, or facility, that may not be feasible across an entire industry segment.

There are two components to this measure. One that focuses locally on California's four key goods movement corridors (Bay Area, Central Valley, Los Angeles/Inland Empire, and San Diego/Border Region), with particular emphasis on ports and intermodal rail operation. This component would achieve improvements in efficiency prior to 2020. The second component, which is discussed later in this section, focuses more globally and further into the future. This component would begin the process for identifying how to move from the current system to a low carbon, sustainable goods movement system, and evaluating opportunities to reduce GHG emissions from the overall goods movement system supply chain.

Key elements of the first component would be to:

- Estimate emissions and key contributors to the emissions;
- Assign emission reduction goals to the key contributors with particular emphasis on ports and intermodal rail operations;
- Identify and develop approaches to achieve the emission reduction goals;
- Develop trade corridor emission reduction plans; and
- Monitor implementation of the progress in achieving the emission reduction targets.

In addition to the Goods Movement System-wide Efficiency Improvement strategy discussed above, several other strategies have been identified as early action measures or will be considered in the near-term to reduce GHG emissions from goods movement activities. These strategies help to achieve the 3.5 $MMTCO_2E$ reductions in GHG emissions from goods movement activities and may be developed separately, or in conjunction with the Goods Movement System-wide Efficiency Improvements Measure. These strategies include:

Ships

Ocean-going vessel speed reduction (VSR) is an early action measure primarily designed to reduce NOx emissions. The measure also provides reductions in diesel PM, SOx, and CO_2 emissions resulting from reduced fuel consumption. A voluntary VSR program is currently in place at the Ports of Los Angeles and Long Beach. For this measure, ARB would conduct a technical assessment of the impacts associated with VSR for ocean-going vessels. As part of the technical assessment, ARB would evaluate emission reduction benefits of a VSR measure for vessels entering and leaving California ports and vessels traveling along the California coast within 24 nautical miles (nm) and 40 nm. Both voluntary and regulatory approaches will be evaluated.

Another ship measure being proposed is the clean ship (or green ship) measure. Under this measure, the concept is to reduce fuel consumption and associated CO_2 emissions through a variety of technologies and strategies that improve the efficiency of ocean-going vessels. Concepts to be investigated include hull and propeller design in new ships, air cavity system to reduce hull resistance, advanced hull and propeller coatings and maintenance programs, advanced engine design optimized for efficiency, advanced heat recovery, operational controls, and wind power assistive devices.

Port Trucks

In December 2007, the ARB approved a regulation to reduce GHGs, diesel PM, and NOx emissions from drayage trucks operating at California's ports and rail yards through retrofits and turnover of pre-1994 trucks. This early action measure will be implemented in two phases. The first phase requires all pre-1994 model year drayage trucks to be replaced or retired with newer model year trucks. The second phase requires all engines to meet or exceed the 2007 California and federal engine emission standards by December 31, 2013.

Long-Haul Trucks

A heavy-duty engine efficiency measure could reduce emissions associated with goods movement through improvements which could involve advanced combustion strategies, friction reduction, waste heat recovery, and electrification of accessories. ARB will consider setting requirements and standards for heavy-duty engine efficiency, if higher levels of efficiencies are not being produced either in response to market forces (fuel costs) or federal standards.

Commercial Harbor Craft

In 2007, the Board adopted an airborne toxic control measure (ATCM) for commercial harbor craft. ARB now proposes development of an educational program to help commercial harbor craft owners and operators improve efficiencies in the operation of commercial harbor craft by utilizing maintenance practices and operational improvements that would reduce GHG emissions. Examples of practices being evaluated that would reduce GHG emissions include: vessel speed optimization, optimized scheduling to reduce fuel consumption, regular engine maintenance, improved hull surface finish (smoothness), reduced hull fouling (seaweed and barnacles), greater use of navigational technologies (GPS, electronic charts, etc.), and improved propeller design and maintenance.

Cargo Handling Equipment

In 2005, the Board adopted an ATCM for cargo handling equipment at ports and intermodal rail yards. Cargo handling equipment includes diesel-fueled vehicles operating at a ports or intermodal rail yards that are used to move cargo or are used for scheduled maintenance or repair activities. ARB would investigate and potentially develop a new measure to restrict unnecessary idling, which would reduce fuel consumption and associated greenhouse gases, criteria pollutants, and toxic air contaminants.

Transport Refrigeration Units

Transport refrigeration units (TRUs) are refrigeration systems powered by internal combustion engines designed to control the environment of temperature sensitive products that are transported in trucks, trailers, shipping containers, and railcars. In 2004, the TRU ATCM was adopted to reduce diesel particulate matter (PM) emissions from TRU engines. A new measure is being proposed for TRUs that would go beyond the current ATCM and would be designed to limit the use of internal-combustion engine-powered TRUs on trucks, trailers, shipping containers, and railcars for extended cold storage at California distribution centers, grocery stores, and elsewhere.

Another strategy proposed for TRUs is the development of energy efficiency guidelines for refrigerated trucks and trailers. There are many possible energy efficiency improvements that translate into fuel savings and GHG emission reductions. To help educate the industry about these efficiency improvements a best practices guidance document, specific to perishable goods transport, would be developed.

Locomotives

While no specific measures that address locomotives individually have been identified at this time, there are emerging technologies that show promise in reducing greenhouse gas emissions from locomotives. Technologies to reduce emissions from locomotives include replacement of conventional switcher locomotives with propulsion systems using multiple (two or three) diesel generators. Locomotives with these systems use engine power more efficiently by being able to better match engine power to the load being moved. These newer switcher locomotives are estimated to reduce fuel consumption by about 20 to 40 percent.

Another technology for switcher locomotives is the battery-hybrid drive, where a smaller diesel generator is used to charge a battery pack that provides power to an electric motor. The diesel generator shuts down when the battery pack is fully charged.

An emerging concept that is under evaluation is the use of a magnetically-levitated ("maglev") cargo system that is electrically propelled. Such a system is under evaluation for a 5 mile stretch from terminals at the Ports of Long Beach or Los Angeles, to the proposed Burlington Northern Santa Fe (BNSF) Southern California International Gateway (SCIG) rail yard facility, and the existing Union Pacific (UP) rail yard Intermodal Container Transfer Facility (ICTF).

Overall, ARB expects that, in addition to GHG reductions, these strategies would reduce diesel particulate matter (PM), NOx, SOx, and fuel consumption. Reductions from many of these measures are already counted in the Diesel Risk Reduction Plan and the Goods Movement Emission Reduction Plan. In addition, many of these reductions will benefit communities impacted by air pollution from goods movement.

Long-Term 2050 Strategies

The electronic toys, clothing, and foodstuffs that California consumers purchase arrive here via a complex and integrated supply chain network that extends beyond California's borders. Achieving our 2050 goals will require California to take a serious look at the overall goods movement system or network and to begin now to put into motion the steps necessary to establish a low carbon sustainable goods movement network. To begin this process, ARB proposes to establish a Goods Movement Vision 2050 taskforce that would be charged with developing the steps needed to move toward a low-carbon, sustainable goods movement network in California by 2050. As part of this element, the taskforce would identify:

- Infrastructure improvements that foster efficient logistics systems and goods movement networks;
- Public policies that support and promote low-carbon goods movement networks;
- Programs to encourage consumer choices that promote efficient transport of goods to and through California; and
- Programs to foster and implement low-carbon transportation innovations.

It is envisioned that this effort will evaluate and consider a wide range of policies and programs that can be leveraged to help improve the overall goods movement system efficiency. Examples of just a few of the types of strategies include product labeling, consumer education, environmental awards, economic incentives, fiscal or technical assistance programs, and infrastructure improvements.

Emissions and Emission Reductions

Measure T-6 targets an emission reduction of 3.5 $MMTCO_2E$ in 2020. ARB estimates that about 90 percent of the emission reductions will result from efficiency improvements that will reduce fuel consumption, and the remaining 10 percent will result from the conversion of diesel engine supplied power to grid supplied electrical power.

ARB also estimates that some of the strategies in this measure will achieve additional GHG emission reductions beyond California. For example, vessel design improvements such as advanced hull and propeller designs would achieve GHG emission reductions wherever the ship travels. Consumer labeling programs that encourage the purchase of lower carbon products could also result in benefits beyond California. These benefits are not quantified.

Estimated Costs and Savings

The costs and cost savings due to Measure T-6 are difficult to estimate at this time because of the variety of control options covered under this measure, the flexibility provided to sources to determine the strategies that work best for them, and because some of the listed strategies are emerging technologies for which cost data is limited or unavailable. However, as shown in Table 8, ARB anticipates that the overall savings due to efficiency improvements and lower energy demand will offset the costs associated with implementing the strategies.

Appendix C: Transportation
Table 8

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Ship Electrification at Ports (Discrete Early Action)*	0.2	0**	ARB	2007/2010

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Goods Movement Efficiency Measures • Goods Movement System-Wide Efficiency Improvements • VSR • Clean Ships • Port Drayage Trucks • Commercial Harbor Craft Maintenance and Design Efficiency • Cargo Handling Equipment Anti-Idling • Transport Refrigeration Units Cold Storage Prohibition and Energy Efficiency	3.5	TBD	ARB	2009-2010

*This measure has already been adopted by ARB.
**Costs and savings for Ship Electrification at Ports are the result of existing state policies and therefore are not attributed to the AB32 GHG emissions reduction program.

ARB assumes the overall cost of the measure will be offset by savings derived from improvements in energy efficiency because of the variety of technologies currently available with relatively short payback periods (e.g. where long-term fuel savings exceed capital costs). For example, a major tug operator is building an advanced hybrid, diesel-electric tugboat that will be launched in late 2008. The tug can use battery power for idle and low load operation when diesel engines are less fuel efficient, and for short bursts of power that supplement the diesel engines. The added cost of the hybrid tug is about $2 million higher than the standard tugboat. However, lower fuel and maintenance costs are expected to result in a payback period of about four years at current diesel fuel prices. The design also incorporates an electric winch system with regenerative braking that can help recharge the batteries. The batteries can also be charged using grid power when the tug is docked.[29]

The use of advanced heat recovery on ocean-going vessels provides another example of a strategy to reduce GHG emissions that can ultimately yield savings. This technology captures the exhaust heat from a ship's engine exhaust to produce steam that can operate a turbine. The power provided by the turbine can produce electric power that would otherwise be provided by diesel powered generators. The manufacturer of one system published a detailed technical paper estimating a pay-back period for this control option

[29] Foss Maritime. Personal communication with ARB staff, August 19, 2008.

ranging from about 5 to 10 years depending on the size of the main engine.[30] However, this estimate was prepared assuming a heavy fuel oil cost of $160 per metric ton. Fuel prices are now about four times higher, so the payback period would be substantially lower.

D. MEDIUM- AND HEAVY-DUTY VEHICLES

(T-7) Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)—Discrete Early Action

This measure would require existing trucks/trailers to be retrofitted with the best available technology and/or ARB approved technology. This measure has been identified as a Discrete Early Action, which means it must be enforceable starting in 2010. Technologies that reduce GHG emissions and improve the fuel efficiency of trucks may include devices that reduce aerodynamic drag and rolling resistance. The requirements would apply to California and out-of-state registered trucks that travel to California. The cost of these retrofits would be recovered over the life of the vehicle through reduced fuel use. This measure would require in-use trucks and trailers to comply through a phase-in schedule starting in 2010 and achieve 100 percent compliance by 2014. Additionally, new 2011 and later tractors and trailers that are sold in or service California would need to be certified for aerodynamic efficiency requirements. The 2020 estimated GHG reductions could be up to 6.4 $MMTCO_2E$ nationwide, of which about 0.93 $MMTCO_2E$ or about 15 percent would occur within California. The Board will consider this regulation in December 2008.

(T-8) Medium- and Heavy-Duty Vehicle Hybridization

Hybrid electric technology offers the potential to significantly reduce GHG emissions and improve fuel efficiency. Hybrid technology provides the greatest benefit when used in vocational applications that have significant urban, stop-and-go driving, idling, and power take-off operations in their duty cycle. Such applications include parcel delivery trucks and vans, utility trucks, garbage trucks, transit buses, and other vocational work trucks. These entities may be affected by this measure. The implementation approach for this measure is to adopt a regulation and/or incentive program that reduces the GHG emissions of these types of new trucks sold in California.

[30] MAN B&W Diesel A/S. "Thermo Efficiency System (TES) for Reduction of Fuel Consumption and CO_2 Emissions." Undated.

Appendix C: Transportation
Table 9

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)* (Discrete Early Action)	0.93†	-521	ARB	2008/Phased-In Schedule for large fleets: 20% by end of 2010; 40% by end of 2011; 65% by end of 2012; 100% by end of 2013
Medium- and Heavy-Duty Vehicle Hybridization	0.5	-6.4	ARB	Pending

*This measure would result in 5.5 $MMTCO_2E$ outside of California that ARB has not accounted for in this plan. In addition, while the net annualized cost of this measure accounts for the full cost of the equipment, only the fuel savings realized when the vehicle is operating in the State are accounted for as a benefit in the calculation. Analysis of the similar U.S. EPA SmartWay program indicates fuel savings can pay for the equipment within a few years.

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

E. VEHICLE USE

(T-3) Regional Transportation-Related Greenhouse Gas Targets

On September 30, 2008, Governor Arnold Schwarzenegger signed Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008) which establishes mechanisms for the development of regional targets for passenger vehicle greenhouse gas reductions. Through the SB 375 process, regions will work to integrate development patterns, the transportation network, and other transportation measures and policies in a way that achieves greenhouse gas emission reductions while meeting regional planning objectives. This new law reflects the importance of achieving significant additional greenhouse gas reductions from changed land use patterns and improved transportation to help achieve the goals of AB 32.

Senate Bill 375 requires ARB to develop, in consultation with metropolitan planning organizations (MPOs), passenger vehicle greenhouse gas emission reductions targets for 2020 and 2035 by September 30, 2010. It sets forth a collaborative process to establish

these targets, including the appointment by ARB of a Regional Targets Advisory Committee to recommend factors and methodologies to be considered for setting greenhouse gas emission reduction targets. The bill creates incentives for local governments and developers by providing relief from certain California Environmental Quality Act (CEQA) requirements for development projects that are consistent with regional plans that achieve the targets.

Reaching the Targets

Transportation planning is done on a regional level in major urban areas, reflecting local land use patterns and decisions. Through efforts such as the "Blueprint" planning model, regions can select future growth scenarios that lead to more environmentally and economically sustainable and energy efficient communities. Blueprint plans are developed through an extensive public process which provides for local participation and accountability and allows regions to plan for population and employment growth along with housing needs, improved transportation infrastructure, retail services, recreation, resource protection and other regional needs. Blueprints have shown how such integrated planning can also lead to substantial financial savings for local and regional governments and the State because of reduced need for roadway expansion, maintenance, and other infrastructure. SB 375 states that it is the Legislature's intent to build upon the successful Blueprint process by requiring metropolitan planning organizations to develop and incorporate sustainable communities strategies that strive to reach regional greenhouse gas reduction targets. MPOs would use the sustainable communities strategy for the land use pattern underlying the region's transportation plan. If the strategy does not meet the target, the MPO must document the impediments and show how the target could be met with an alternative planning strategy. ARB will work closely with MPOs to develop and successfully implement sustainable communities strategies that meet the target.

Local governments will play a significant role in the regional planning process to reach passenger vehicle greenhouse gas reduction targets. Local governments have the ability to directly influence both the siting and design of new residential and commercial developments in a way that reduces greenhouse gases associated with vehicle travel, as well as energy, water, and waste. A partnership of local and regional agencies is needed to create a sustainable vision for the future that accommodates population growth in a carbon efficient way. Integration of the sustainable communities strategies or alternative planning strategies with local general plans will be key to the achievement of these goals.

State, regional, and local agencies must work together to prioritize and create the supporting policies, programs, incentives, guidance, and funding to assist local actions to help ensure regional targets are met. The supporting foundation needed to implement these land use and transportation strategies includes the following:

Exercise State Leadership. Promote low-impact development and reduce greenhouse gas emissions across all levels of government through the State's own building, operation, and planning efforts. The State will work to implement the State's planning priorities as stated in AB 857 (Wiggins) Infrastructure Planning: Priorities and Funding (Chapter 1016, Statutes of 2002). The State will use the Strategic

Growth Council as a coordination mechanism for meeting State government greenhouse gas reduction goals. The State will provide technical, fiscal, and regulatory priority to projects and developments consistent with regional blueprints that meet established targets. In addition, the Business, Transportation, and Housing Agency (BTH) will convene a group to identify regulatory barriers to housing and efficient land use and prepare recommendations on how such barriers can be addressed.

Pursue Funding Sources and Allocate Effectively. Align existing funding sources and help secure new funding to implement blueprints at the local level, support local climate change planning and projects, and incentivize the desired high-quality, low-impact projects. State agencies will allocate infrastructure bonds, where appropriate, to best promote efficiency, sustainability, and California's environmental, social equity, and economic goals. All levels of government should include greenhouse gas considerations in their funding decisions related to development.

Improve Measurement through Partnerships. Develop local government quantification protocols, improve transportation demand estimation tools, and develop better land use and transportation models that reflect the benefits of high-quality, low-impact development. The State will work with regions and local governments to identify existing models and tools for planning and progress measurement that better meet local and regional needs. The State will also partner with regional governments on the funding for and ongoing development of activity-based travel models in the major regions of the State, as recommended by the California Transportation Commissions' Regional Transportation Plan Guidelines, to enhance the quality of information and analysis presented to educate decision-makers and the public at large regarding the implications of various land use and transportation policy options.

Promote High-Quality, Low-Impact (Resource-Efficient) Communities. Establish a variety of mechanisms to recognize and support the building of livable, innovative projects and communities with low-carbon footprints to provide prototypes for future development. This includes support for infill, affordable and transit-oriented housing development and the land use changes necessary to increase such developments. Additionally, there must be recognition of broad community planning issues that will assure the overall success of the land use measures in the plan. State, regional, and local governments will pursue supporting mechanisms including regulatory actions, targeted incentives, and targeted funding.

Identify Funding Sources for Local Level GHG Reduction Strategies. Local governments need financial resources to engage in blueprint planning processes, update general plans and zoning codes, as well as to develop strategies to comprehensively reduce municipal and community GHG emissions. There is also a need for local government infrastructure funding to support more compact, infill development. ARB will pursue and investigate strategies to provide stable funding for these activities. The State will work with local governments to identify and

provide guidance on best practices to reduce GHG emissions from new and existing development. Specific attention and focus will also be given to strategies and resources that address GHG emissions reductions from existing development.

Adopt Proven Measures. Pursue proven emission reduction strategies, such as indirect source rules that mitigate high carbon footprint development and pricing measures that more accurately reflect the cost of driving and provide people with more transportation choices. All levels of government should adopt and implement feasible strategies, placing a high priority on measures with public health co-benefits.

Amend CEQA Guidelines to Account for Greenhouse Gas Emissions. Provide state guidance for determining significance and mitigating the GHG emissions of new projects. The Office of Planning and Research and the Resources Agency are developing proposed amendments to the CEQA Guidelines to provide guidance on how to address GHG emissions in CEQA documents. As required by Senate Bill 97 (Chapter 185, statutes of 2007) the amended CEQA Guidelines will be adopted by January 1, 2010. These guidelines will support projects that lower the carbon footprint of new development, and encourage programmatic mitigation strategies that may include reliance on adopted regional blueprint plans, Climate Action Plans, and general plans that meet regional and local GHG emissions targets and that have also undergone CEQA review.

Conduct Outreach and Engage the Public. Secure public support for the actions necessary to reduce greenhouse gas emissions from land use and transportation, and provide outreach and public education programs necessary to promote individual actions that help reduce greenhouse gas emissions. All levels of government, the business and development community, and the environmental and public health communities will work together to provide information on models/protocols, training, best practices, and funding sources for these outreach programs. The State will support and coordinate public engagement processes, including supporting public outreach efforts as integral elements in local and regional comprehensive planning efforts.

Any regulations, policies or guidelines that might impact residential development must ensure that housing supply and affordability needs, including the Regional Housing Needs Assessment, are advanced and not impeded.

Enhanced transit service combined with incentives for land use development that provides a better market for transit is key to reaching regional targets. Operating expenses comprise about 80 percent of regional transit spending, so funding of transit expansion is challenging. An ongoing and secure source of additional transit funding should be pursued to help regions integrate smart land use decisions with effective transit options. The reauthorization of the federal transportation funding bill, SAFETEA-LU, provides one opportunity to pursue funding for transit. This is one of several key issues California's transportation stakeholders have agreed to pursue next year during reauthorization efforts.

SB 375 and the regional target process established by the bill maintain the regions' flexibility in the development of their sustainable communities strategies. There are many different ways regions can plan and work toward reducing the growth in vehicle travel. Increasing low-carbon travel choices (transit, carpooling, walking and biking) and the need for development of the land use patterns and infrastructure that support these low-carbon modes of travel decrease average vehicle trip lengths by bringing more people closer to more destinations. The need for integrated strategies is supported by the modeling literature which indicates that land use and transit strategies on their own do not achieve very significant impacts but in combination provide more robust benefits. To achieve these results, barriers to more efficient land use and transit strategies must be addressed and could include the State and regions providing guidance or incentives for streamlining local approval processes and reducing discretionary approvals for multifamily, infill and affordable housing developments.

Supporting measures that should be considered in both the regional target-setting and sustainable communities strategy processes include the following:

- Congestion pricing strategies can provide a method of efficiently managing traffic demand while raising funds for needed transit, bike and pedestrian infrastructure investment. These strategies also have the potential to provide additional funds to augment declining transportation gas tax revenues. Federal approval and State authorization, however, must be provided for regional implementation of most pricing measures.

- Indirect source rules for new development have already been implemented by some local air districts and proposed by others for purposes of criteria pollution reduction. Regions should evaluate the need for measures that would ensure the mitigation of high carbon footprint development outside of the sustainable communities strategies or alternative planning strategies that meet the targets established under SB 375. In developing and implementing indirect source rules, local governments should consider the full spectrum of factors including affordable housing availability, economic impacts, other existing mitigation requirements (including fees), and potential unintended consequences.

- Programs to reduce vehicle trips, like employee transit incentives, telework programs, car sharing, parking policies, public education programs and other strategies that can enhance and complement land use and transportation strategies can be implemented and coordinated by regional and local agencies and stakeholder groups.

Separate emission reduction estimates for these three strategies are not quantified here. As regional targets are developed in the SB 375 process, ARB will work with regions to quantify the benefits in the context of the targets.

Another way to encourage greenhouse gas reductions from vehicle travel is through the concept of Pay-As-You-Drive Insurance (PAYD). Under a PAYD insurance structure,

drivers realize a direct financial incentive from driving less as premiums are heavily weighted on actual mileage. The California Insurance Commissioner recently announced support for PAYD and has proposed regulations that would allow insurance companies to make PAYD insurance available on a voluntary basis in California.

Estimating the GHG Benefits of Regional Targets

The ARB estimate of the statewide benefit of regional transportation-related greenhouse gas emission reduction targets is based on research results quantifying the current effects of land use and transportation strategies on passenger vehicle greenhouse gas emissions. The estimate does not establish the statewide metric for regional targets that must be developed as SB 375 is implemented.

To help staff estimate the possible impacts of land use and transportation strategies for the Scoping Plan, ARB co-funded a study conducted by the UC Berkeley Transportation Sustainability Research Center, led by Dr. Caroline Rodier, to review the modeling literature of land use, transit, and auto pricing strategies.[31] The UC Berkeley study analyzed the results of over twenty modeling studies from California (including modeling scenarios from the major MPOs), other states, and Europe. The final report for the study, which was completed on August 1, 2008, found that the modeling estimates fell in a range of 0.4 to 7.7 percent reduction in per capita vehicle miles traveled (VMT) from a trend or business-as-usual base case due to land use and transit strategies over a 10-year time horizon. This estimate does not include the potential reductions from other policies such as pricing which will be considered during the target setting process. To provide a reasonable estimate of the reductions achievable from this strategy, ARB chose to use the study's median value of 4 percent per capita VMT reduction, which calculates to a statewide reduction of 6.4 $MMTCO_2E$ from the 2020 passenger vehicle baseline that is modified to 5 $MMTCO_2E$ reductions when taking into account the emission reductions from the vehicle technology and efficiency measures in the Scoping Plan. This value should not be interpreted as the final estimate of the benefits of this measure. The current academic literature supports this realistic statewide estimate of potential benefits, but the ultimate benefit will be determined as an outcome of SB 375 implementation on a regional level. The incentives for sustainable planning in SB 375 can set a new path for California. ARB's establishment of regional targets in 2010, combined with the Regional Targets Advisory Committee process, provides a clear mechanism for maximizing the benefits of this measure.

The estimate for regional targets in the Discussion Draft was "at least 2 MMT" which the Appendices indicated was a preliminary estimate that may change as a result of further analysis. ARB staff based its higher estimate on several factors, including data from the UC Berkeley study that was not available at the time of the draft.

- The modeling scenario analysis performed in the UC Berkeley review indicated that the studies reporting the highest impacts tended to be those that used the most

[31] Rodier, Caroline, UC Berkeley, Transportation sustainability Research Center, *"A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions," August 2008.* http://www.arb.ca.gov/planning/tsaq/docs/rodier_8-1-08_trb_paper.pdf

sophisticated land use and travel models which more accurately assess the travel effects of integrated land use and transit strategies so common in California blueprint planning. The review also suggested that the lower impact estimates were often those with less sophisticated modeling tools or very modest strategies.

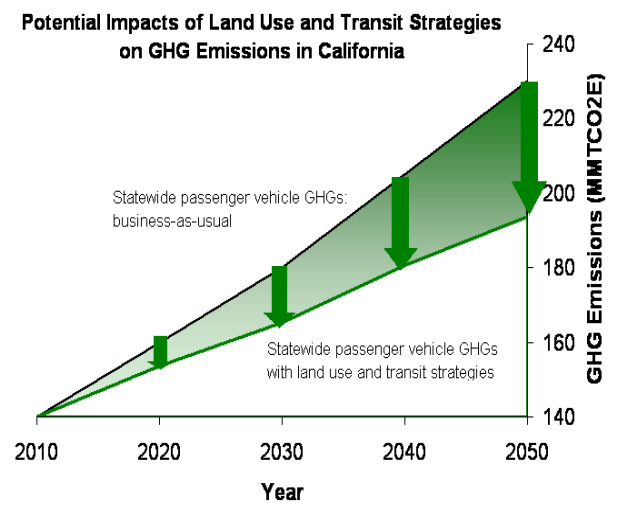
- It is common practice for modeling studies to show results for all on-road vehicle travel; so the range of percentage impacts reported in the UC Berkeley review would show higher percentage impacts if passenger vehicles were assessed separately.
- Modeling literature includes very few results for a 10-year time horizon. The UC Berkeley analysis took the time to perform a uniform extrapolation method to estimate 10-year results from all the modeling scenarios reviewed, allowing ARB staff to more fully consider the possible impacts from a shorter time horizon.
- A recent analysis on the impact of gas prices on transportation behavior indicates a growing market for infill development closer to job centers and transit that could possibly speed up the rate of land use strategies in a 10-year time horizon (SACOG, Item #08-8-14, Transportation Committee, July 30, 2008).

The UC Berkeley literature review helps point out that a range of impacts in different regions is due to many factors, including the capacity for reductions that takes into account the current built environment of development patterns, housing and job densities, the transportation system, and other factors; modeling capabilities of regions which can effect policy making as well as estimates; and the aggressiveness of land use and transportation planning policies in a region, including the projected level of more compact, mixed-use development with higher residential and employment densities served by transit. Thus, just as the impact estimate of regional targets does not establish a statewide metric for regional targets, the estimate does not presume a uniform percentage reduction from each region in the State.

Long-Range Benefits of Land Use and Transportation Strategies

It is important to emphasize the long-range benefits of land use and transportation strategies, especially in helping California reach its 2050 goal of 80 percent below 1990 levels. The benefits of integrated land use and transportation strategies accumulate over time as new development patterns become a larger and larger part of the overall regional picture. Population is estimated to increase by 13 percent between 2010 and 2020, but is projected to increase 52 percent by 2050. The impact of land use and transportation strategies may be modest by 2020, but if we begin now, the accumulation of benefits over the next 20, 30, 40 years can result in very significant benefits compared to business as usual. The UC

Appendix C: Transportation-Figure 4



Berkeley review indicates that per capita vehicle travel reductions due to land use and transportation strategies could double in the 20-year time horizon and double again by 2050. Figure 4 above illustrates the potential long-range benefits of land use and transportation strategies based on the scenario modeling median values in the UC Berkeley review[32]. These benefits, in combination with our vehicles and fuel standards will help California to cost-effectively achieve its 2050 greenhouse gas goals.

Additional GHG Benefits of Regional Targets and Land Use Strategies

Land use and transportation measures that help reduce vehicle travel will also provide multiple benefits to Californians. Quality of life will be improved by increasing access to a variety of mobility options such as transit, biking, and walking, and will provide a diversity of housing options focused on proximity to jobs, recreation, and services. Other important State and community goals that could be met through better integrated land use and transportation planning include agricultural, open space and habitat preservation, improved water quality, positive health effects, and the reduction of smog forming pollutants.

The impact of growing more sustainably by building more compact, mixed-use developments near jobs and transit will also provide real greenhouse gas energy savings. Heating and cooling less space results in less energy used. These land use-related energy conservation savings will help the Scoping Plan's Energy Efficiency measure to achieve the goal of reducing electricity and natural gas usage. ARB is continuing to evaluate the GHG reductions that may be additional to the proposed measures in this plan.

Costs

Total cost of emissions reductions for this measure will ultimately depend on the selection of strategies to be implemented. Overall, changes in this sector are anticipated to result in long term cost savings for all levels of government. While some savings may accrue in the 2020 timeframe, current research and practice indicates that much greater cost savings from smarter growth strategies and reduced vehicle travel are likely to accrue in the 2050 timeframe, and most significantly from avoided capital cost expenditures. Recent scenario planning work reveals order of magnitude figures for cost savings on state- and region- wide bases. At the regional level, the Sacramento region's Blueprint planning process has projected that implementation of their compact regional growth plan will yield a savings of about 12 percent ($1.8 billion) in transportation system capital spending from a business as usual scenario in 2050 (SACOG Blueprint 2004). In 2000, the statewide Envision Utah scenario planning process estimated that implementation of a statewide compact growth plan would yield a potential 17 percent ($4.5 billion) infrastructure cost savings from business as usual development (Ewing et al. 2007, Envision Utah 2000).

Recognizing that resource allocation is often a balancing act, local, regional, and state agencies will need to work together to identify, leverage, and use existing funds, resources, and tools to advance GHG efficient land use and transportation efforts, with

[32] Note that Figure 4 here does not include the benefits from continued reduction in vehicle and fuel GHG's due to our other programs.

special attention towards investments that also help forward other economic, health, social, and environmental goals.

Appendix C: Regional Targets
Table 10

Reduction Measure	Potential 2020 Reductions MMTCO_2E	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Regional Transportation-Related Greenhouse Gas Targets*	5	-1554 (aggregated)	Local Governments / ARB / Regional Planning Agencies	Local actions have begun already in some areas Set targets by January 1, 2010

*This is not the SB 375 regional target. ARB will establish regional targets for each MPO region following the input of the regional targets advisory committee and a consultation process with MPO's and other stakeholders per SB 375
†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

Other State Agencies' Supporting Measures

The Land Use Subgroup of the Climate Action Team (LUSCAT) April 2008 submittal to ARB included actions that State agencies have committed to implementing that will help create the supporting foundation for actions by local and regional agencies. The Department of Housing and Community Development, the State Water Resources Control Board, the California Energy Commission, the California Department of Transportation, the Department of Conservation, and the Governor's Office of Planning and Research all submitted strategies to LUSCAT. No greenhouse gas emission reduction estimates were included in most actions; however, in aggregate they may result in substantial assistance for the local actions necessary to reach regional targets.

Technical Assistance

Housing Element Technical Assistance. The State Department of Housing and Community Development will update technical assistance and outreach efforts to include climate change considerations for housing elements.

Energy-Aware Planning Guide Update. The California Energy Commission will update the existing Energy Aware Guide to provide policy and technical assistance to regional and local governments.

GHG Mobile Source Technical Guidance. The California Department of Transportation will set up a framework that ensures that GHG emissions from mobile sources are addressed in the transportation plans and projects. The framework would include

development of appropriate mitigation measures, technical guidance and modeling tools, and incorporate analysis of economic and environmental benefits associated with energy efficiency measures and emission reduction strategies into the State Transportation Plan and subsequent Action Plan.

2010 State Transportation Improvement Program (STIP) Guidelines. The California Transportation Commission will update the STIP Guidelines to describe policy, standards, criteria and procedures for the development, adoption and implementation of the STIP. Potential strategy metrics include the number of projects that promote pedestrian, bicycle, transit and rail access.

Staff Training and Public Education. The California Department of Transportation will include the subject of climate change and GHG emissions in the Department's training program, enhance outreach efforts, maintain a website and convene educational forums.

State Guidelines

Regional Transportation Plan (RTP) Guidelines Update. The California Transportation Commission and California Department of Transportation will update the RTP Guidelines to incorporate meeting AB 32 GHG emission reduction targets and to enhance the use of regional blueprint plans.

GHG Emissions in CEQA Guidelines. The Governor's Office of Planning and Research will develop CEQA guidelines for mitigation of GHG emissions. Per SB 97, the guidelines must be submitted to the Resources Agency by July 1, 2009 and the Resources Agency shall adopt the guidelines by January 1, 2010.

Watershed-Friendly Landscape Guidelines. The California Integrated Waste Management Board is developing a set of landscape guidelines for use throughout the State. A well-designed and maintained landscape can cost less to maintain in the long run by consuming fewer resources. Although the primary objective is to protect watersheds through the use of sustainable landscaping practices, a secondary motivation is the reduction or avoidance of GHG emissions. These guidelines will be consistent with the provisions of AB 1881, signed by the Governor on September 28, 2006. This legislation requires the California Department of Water Resources (DWR) to update the State Model Water Efficient Landscape Ordinance, based on recommendations set forth in the Landscape Task Force report, by January 1, 2009.

Funding, Incentives and Grants

Affordable Housing Finance Incentives. State Department of Housing and Community Development will promote emission reductions and energy conservation in HCD administered funding programs.

Climate Change Criteria for State Water Resources Control Board Grants. The State Water Resources Control Board will incorporate climate change criteria in the new grant programs under the Safe Drinking Water, Water Quality and Supply, Flood Control,

River and Coastal Protection Bond Act of 2006 (Proposition 84) – Clean Beaches, Storm Water, and Agricultural Water Quality grant programs.

Updated and New Programs or Policies

Complete Streets. The California Department of Transportation will provide improved safety and convenient access to all users of streets, roads and highways. Implementation of greening policies (street trees and green landscaping) are essential components to this measure. Other components include the use of alternate paving, retrofit of existing signals and crosswalks with improved technologies, inclusions of Complete Streets policies and strategies in General Plans, among other infrastructural improvements.

Smart Mobility Framework. This framework, under development by Caltrans, U.S. EPA, and a consultant team, will create an assessment screening tool that will advise transportation infrastructure planning and investment decisions consistent with "Smart Mobility" principles. The tool will foster implementation of the Governor's Strategic Growth Plan and will help the Department address GHG reductions within its own operations. Through Caltrans' leadership and extensive collaboration with local and regional partners, the tool will be expanded and made available for use by local and regional agencies to assess their plans, programs, and projects against smart mobility principles.

Reverse Perverse Incentives to Develop Agricultural Lands. The Department of Conservation will determine whether state and federal tax law encourages the conversion of agricultural lands to urban or other uses.

Working Lands Protocol Pilot Program. The Department of Conservation proposes a strategy to develop a model planning program to guide local land use decision makers in valuing ecosystem services on land.

Transfer of Development Rights. The Department of Conservation proposes to allow an individual with a zoning or other planning right to develop residences, to sell that development right to another person, gaining the seller income and allowing an increase of residential density for the buyer. This could be used as a method to support other (Blueprint) planning goals and objectives.

Subsurface Cleanup Technology. The State Water Resources Control Board may, upon approval, set up a strategy to require the lifecycle of GHG emissions to be calculated for contaminant removal technologies. Emissions calculations would be considered when evaluating the preferred technology for a given cleanup site. Periodic cleanup reports would be required to include actual GHG emission data, based on hours of operation, utility bills or other readily available information.

F. RAIL

(T-9) High Speed Rail

This measure supports implementation of plans to construct and operate a High Speed Rail (HSR) between Northern and Southern California. As planned, the HSR is a 700 mile long high speed rail system capable of speeds in excess of 200 miles per hour on dedicated, fully-grade separated tracks with state-of-the-art safety, signaling and automated rail control systems. The system will serve the major metropolitan centers of California in 2030 and is projected to displace between 86 and 117 million riders from other travel modes in 2030. For Phase 1 of the HSR system, between San Francisco and Anaheim, 2020 is projected to be the first year of service, with 26 percent of the projected full system 2030 ridership levels.

Development of HSR presents a significant opportunity to reduce greenhouse gas emissions by offering the state more GHG efficient travel options and alternatives to business as usual.

HSR implementation was approved by the voters in November 2008. Construction of HSR is anticipated to begin in 2010, with full implementation anticipated in 2030.

Based on best available data, construction costs of the HSR system are currently estimated to be $40 billion, and by 2030, the system is projected to generate nearly $900 million in revenues and return a surplus to the state of more than $300 million. Neither the costs of, nor the revenues from the High Speed Rail measure are attributable to AB 32 implementation because they were already underway.

In order to ensure GHG emissions benefits from HSR, it is imperative that supplementary land use strategies are implemented. These strategies should ensure that growth around the rail is accommodated by GHG efficient land use patterns. There are a number of different approaches to accomplish this that would need to be further analyzed. One example would be to create an interregional transportation and land use body that would identify ‘smart corridor’ development areas around the rail system for preferential funding and permitting incentives.

Appendix C: Transportation
Table 11

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
High Speed Rail	1*	0**	TBD	2010-2030

*Estimates are based on the benefits of displacing air passengers and motor vehicle passengers minus the energy to operate HSR.
**Costs and savings for High Speed Rail are the result of existing state policies and therefore are not attributed to the AB32 GHG emissions reduction program.

5. ELECTRICITY AND NATURAL GAS

This section includes the following measures:

Recommended Actions

California Cap-and-Trade Program Linked to the Western Climate Initiative

Energy Efficiency

- **(E-1 and CR-1) Energy Efficiency**
- **(CR-2) Solar Water Heating[33]**
- **(E-2) Increasing Combined Heat and Power**

Renewable Energy

- **(E-3) Renewables Portfolio Standard**
- **(E-4) Million Solar Roofs**

ARB worked closely with the CAT and its sector-specific subgroups in developing the measures included in this Plan. This input was evaluated and analyzed by ARB and is reflected in the measures included in this sector.

Overview

The California economy, and indeed the well-being of all California's citizens, depends on an adequate, reasonably-priced, and environmentally-sound supply of energy. Yet, uncontrolled fossil-fuel combustion produces greenhouse gases (GHGs), the primary contributor to climate change. California's challenge, like that of the rest of the world, is to maintain a growing economy while decreasing energy-related contributions to GHG emissions and resulting adverse environmental consequences. Two overarching strategies for obtaining GHG reductions from the electricity and natural gas sectors are demand-side strategies that reduce energy use, and supply-side strategies that lower GHG emissions associated with electricity generation.

California has a long history of pursuing energy efficiency and other demand-side management strategies, as a cost-effective and successful means of reducing California's energy needs and forestalling the need for additional power plants. Looking ahead, energy efficiency will be California's most effective tool for achieving GHG reductions in the electricity and natural gas sectors. California must enhance existing efficiency programs and institute new policies and programs to achieve unprecedented levels of energy savings.

Supply-side strategies complement demand-side strategies by reducing the emissions associated with electricity generation. California has made commitments to renewable energy and will continue to push the electric utilities and other electric service providers (ESPs) to meet increasing portions of their energy resource portfolios with both large-scale and distributed

[33] Solar Water Heating is both an Energy Efficiency and Renewable Energy measure. In many applications, solar water heating supplements natural gas water heating. Both solar water heating and increased efficiency in natural gas water heating results in a reduced on-site gas consumption. From a "supply side of the meter, " or carbon emissions reduction viewpoint, efficient use of solar water heating are indistinguishable.

renewable generation, including solar resources. Emission reductions will also come from increased use of other forms of distributed generation such as fuel cells, and combined heat and power (CHP) systems.

Finally, there are mechanisms that could specifically target high-emitting sources of electricity, such as coal, by putting limitations on the emissions associated with electricity that retail providers purchase and/or deliver to California consumers. The Emissions Performance Standard (EPS), is an existing law[34] that precludes California's electric service providers from making investments in, or using long term contracts to procure baseload electricity generation that emits more carbon dioxide than a combined cycle gas turbine (CCGT). The EPS effectively prohibits the procurement of baseload energy from coal-fired power plants (unless they sequester CO_2) and other higher-emitting power plants. During its rulemaking proceedings for the proposed EPS for investor-owned utilities, the CPUC noted that the measure had helped prevent the development of 30 coal-fired power plants that had been proposed to serve California's electricity market. This measure's could influence the power-development market in the western U.S., potentially resulting in reduced development of other high carbon- or high GHG-emitting facilities in the future.

Background

This section of the Scoping Plan addresses emissions associated with electricity production for the residential, commercial and industrial sectors, and natural gas consumption in residential and commercial applications. Emissions due to the extraction, refining, and transportation of fuels, and industrial uses of natural gas, are addressed in the Industrial Sector. CHP is discussed here and in the Industrial Sector; however, GHG reductions are attributed to the Electricity Sector.

Electricity generation from central power plants and distributed sources such as CHP systems was responsible for approximately one quarter of all greenhouse gas emissions in California in 2004, or about 120 $MMTCO_2E$. This makes electricity production second only to transportation in terms of its contribution to California's carbon footprint. Natural gas consumption in residential and commercial buildings accounted for about nine percent of GHG emissions, and the additional emissions are attributable to the heat output portion of CHP.

Electricity Overview

California's energy ownership and delivery structure is complex and involves many different players. Five major utilities provide about 80 percent of the electricity currently consumed in California. These utilities are: Pacific Gas and Electric Company, Southern California Edison, San Diego Gas & Electric; Los Angeles Department of Water and Power, and Sacramento Municipal Utility District. About 70 other entities provide the remaining 20 percent. These include Energy Service Providers (ESPs), small and multi-jurisdictional investor-owned utilities, small publicly-owned utilities, irrigation and water districts, rural cooperatives, Native American utilities, and the California Department of Water Resources. This electricity is delivered through a network of transmission and distribution lines that connect California to the other western states. Distribution systems transfer high-voltage power from the transmission grid through

[34] CCR §§2900-13 and PUC §§340-341. The EPS requirement was established by regulation pursuant to AB 1368. The performance standard was developed for investor-owned utilities by the CPUC, and for publicly-owned utilities by the Energy Commission. The standards are equivalent, and limit emissions to 1,100 pounds of CO_2 per MWh.

substations, where the voltage is reduced. From the substation, distribution lines deliver power to customers.

California's electricity supply is quite diverse, with electricity coming from: fossil fuels; renewable resources such as small hydroelectric, wind, solar, biomass, and geothermal; distributed sources such as CHP and solar photovoltaic systems; large hydroelectric sources such as Shasta and Bonneville Dams; and nuclear facilities. This resource mix has changed over the years. In the late 1970s, petroleum was the fuel source for over half of the state's electricity. Today, cleaner-burning natural gas produces between 40 and 45 percent of the state's electricity, and renewable resources account for about 12 percent[35]. The fuel diversity in this electricity mix helps to insulate California's economy from price shocks and supply disruptions, increases the reliability of the electricity system, and provides multiple environmental benefits.

The exact makeup of California's electricity supply varies from year to year primarily as a result of two factors: the variability of hydroelectric resources, and increasing amounts of renewable energy resources over time. The availability of energy from hydroelectric resources varies significantly depending upon precipitation patterns in California and the Pacific Northwest. A year in which there is below average rainfall or snowpack means that less electricity is produced from hydro-electric resources, and other resources (usually natural gas) must pick up the difference.

Over the last three decades, the state has built one of the largest and most diverse renewable generation portfolios in the world. As California meets its Renewables Portfolio Standard, renewables displace fossil fuels in the overall mix. It should be noted, however, that conventional resources – natural gas, nuclear, coal and large hydroelectric – will continue to be the mainstay of the state's resource mix through the 2020 timeframe. Even when California reaches its 33 percent renewable energy target, two-thirds of the state's electricity will still come from large hydropower, natural gas, and other conventional sources.

Between two-thirds and three-quarters of electricity consumed in California is generated in state, with the rest being imported from other western states, British Columbia and northern Mexico. A disproportionate share of California's electricity-related GHG emissions can be attributed to these imports. While imported electricity accounts for about 25 to 30 percent of total electricity consumed in-state, out-of-state power plants contribute more than half of the GHG emissions associated with California's electricity consumption. This is because California's imports are dominated by coal-generated electricity. California's Emission Performance Standard (EPS), discussed in greater detail in the *GHG Reduction Strategies for 2020*, below, will help to reduce emissions related to out-of-state coal generation.

Power plant emissions of criteria pollutants and toxics are strictly regulated in California. Fossil fuel-based electricity generation emits ozone precursors (VOC and NO_x) and particulate matter, both of which are serious public health concerns in our urban nonattainment areas. The Clean Air Act State Implementation Plan control measures will continue to reduce power plant-related emissions of criteria pollutants, and ARB's existing toxics program will continue to focus on

[35] As a percentage of 2007 total system power. See California Energy Commission, April 2008, 2007 Net System Power Report, Commission Report, CEC-200-2008-002-CMF, http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002-CMF.PDF.

emissions of toxic air contaminants. Further reductions in statewide emissions of these pollutants are expected as California's electricity mix shifts to increased percentages of renewable resources.

Several agencies regulate or oversee various parts of the industry. The California Public Utilities Commission (CPUC) has authority to regulate investor owned utilities (IOUs), community choice aggregators (CCAs), and ESPs. The publicly owned utilities (POUs) are largely self-governed, but recent legislation gives the CEC authority to track their energy efficiency programs and renewable energy purchases, and to regulate new long-term POU energy contracts and investments for baseload power, including an emission performance standard for GHG emissions associated with long-term POU contracts[36]. ARB and local air districts provide air regulation over in-state generation facilities, and the CEC has permitting authority over large thermal power plants.

Natural Gas Overview

The largest use of natural gas is as fuel for electrical generation, which is responsible for nearly half of all natural gas consumed in the state. Residential customers use another 22 percent of the natural gas and of that amount, 88 percent is used for space and water heating. The remainder is used for commercial and industrial purposes. Commercial and industrial uses generally include boilers, heaters, and gas turbines (such as those used for CHP).

In 2006, California produced 13.5 percent of its own natural gas, with the remaining 86.5 percent coming from the southwest, Canada, and the Rocky Mountain region by pipeline. Once the gas arrives in California, 98 percent of it is distributed by the state's three major gas utilities – SDG&E, Southern California Gas Company, and PG&E. These utilities pipe natural gas to industrial, commercial, and residential customers.

California's natural gas demand growth is expected to be slower than the rest of the nation's, due largely to the state's energy efficiency programs and the use of renewable energy for electricity generation. Nevertheless, under a business-as-usual scenario, the demand for natural gas is projected to steadily increase.

This section of the Scoping Plan addresses GHG emissions related to commercial and residential use of natural gas for space heating, cooking, hot water (otherwise known as the "commercial / residential sector"), electricity generation, and CHP. CHP is also addressed in the Industrial Sector but the GHG reductions are attributed to the Electricity Sector.

Energy Efficiency and Conservation

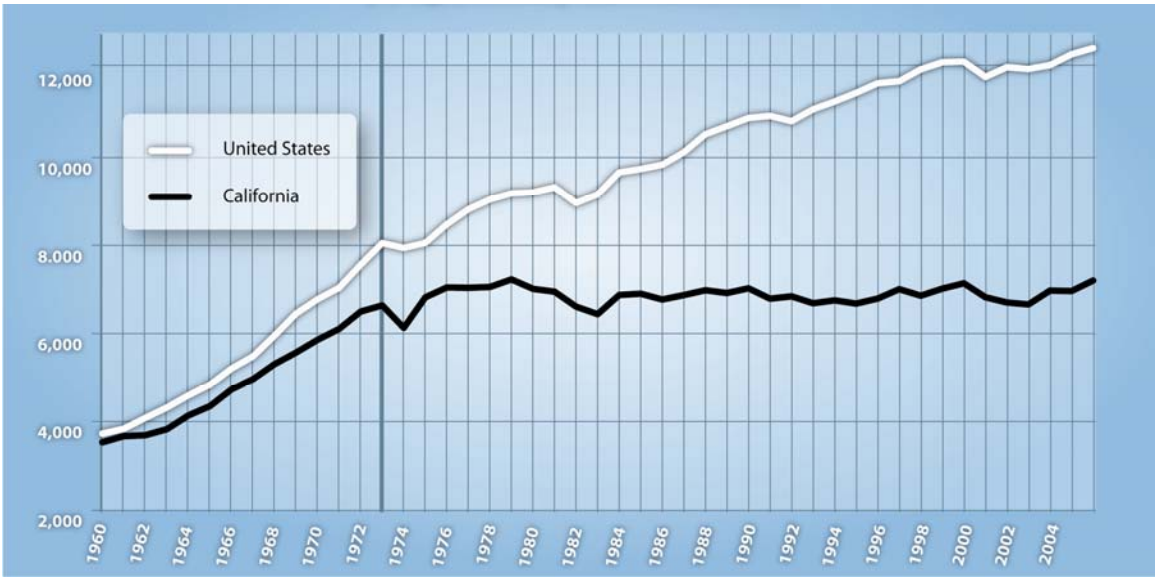
Energy efficiency is the cornerstone of California's energy strategy and is the state's highest priority energy resource. For more than three decades, California has led the nation with aggressive building and appliance standards and utility energy efficiency programs. These combined efforts are saving more than 40,000 GWh of electricity annually[37] – enough to power almost six million California homes. Due in part to these successful standards and programs, California uses less electricity per person than any other state in the nation. While per capita

[36] For more information, see the Energy Commission's web page on SB 1368 Emission Performance Standards, http://www.energy.ca.gov/emission_standards/.
[37] California Energy Commission, 2005, *Integrated Energy Policy Report*, CEC-100-2005-007CMF

electricity consumption in the United States increased by nearly 50 percent over the past 30 years, California's per capita electricity use remained virtually flat as illustrated in Appendix C Figure 5**.** Except for its use in generating electricity, natural gas consumption has also decreased on a per capita basis as building and appliance codes reduced the amount of natural gas needed to heat water, homes, and offices. California has only begun to tap its potential energy efficiency resources and can continue to achieve significant energy savings through further investments in energy efficiency technologies, standards, and programs.

Conservation is another strategy that reduces energy demand. Energy efficiency and conservation both have the effect of reducing the need for energy generation and fuel use, to the extent that they outweigh increased demand due to population and economic growth. Whereas energy efficiency is accomplished through better technology, conservation refers to changes in behavior. Buying a more efficient light bulb is an example of energy efficiency; turning it off as you leave the room is an example of conservation. During the electricity crisis of 2001, California consumers responded to the Flex Your Power campaign with impressive levels of conservation, proving that conservation is a viable strategy for reducing energy use.

Appendix C: Electricity and Natural Gas
Figure 5: Per Capita Electricity Sales in Kilowatt Hours – California versus the United States



Source: California Energy Commission

Challenges to Meeting Future Demand

Population Growth and Energy Consumption Trends

Unless efficiency and conservation programs are greatly expanded, population growth and changes in consumer behavior are expected to exceed the ability of current standards and utility programs to hold down energy consumption. Between now and 2020, the State's population is expected to grow to 44 million, or about 1.4 percent annually. The Southland's Inland Empire, and the Sacramento and San Joaquin Valleys are experiencing the highest rates of growth. The warmer and longer summers in these areas translate to more air conditioning use, especially during peak periods that coincide with the hottest time of the day. Further, if past trends

continue, consumers will purchase increasingly larger homes and appliances as well as a growing number of electronics and gadgets. These trends, taken together, will cause per capita energy consumption to increase, rather than decline, unless they are countered with much more aggressive energy efficiency measures.

Electrification of Transportation

A second challenge for this sector is likely to come from transportation fuel switching – switching from gasoline and diesel to electricity. Examples are port electrification, plug-in vehicles, and the production of hydrogen (via electrolysis) for vehicles powered by fuel cells or internal combustion engines. As the transportation sector increasingly looks to alternative fuels in an effort to reduce GHG emissions, electricity consumption is expected to increase commensurately.

Climate Change Effects

Another significant challenge in the energy sector may be climate change itself. Increasing average temperatures and incidences of heat waves – a result of climate change – has the potential to increase the demand for space cooling. Given the current infrastructure in place, this could force our less efficient power plants to run more often to meet demand. During the summer months, California also imports energy generated by hydropower from the Northwest to meet peak demand. Decreasing snowpack within California and throughout the west is likely to reduce the availability of this clean and relatively inexpensive hydropower source, further exacerbating the problem. In addition, a large number of power plants in California are located along the coast. The potential for sea level rise associated with climate change could have detrimental effects on the operation of those plants. In effect, the electricity sector must adapt to aspects of climate change that may already be unavoidable even as it plans to meet AB 32 GHG reduction goals to reduce the likelihood of further climate change.[38]

Building Transmission for Renewables and Modernizing Electricity Infrastructure

Population growth in hot areas and the need to reach remote renewable generation regions both require adding electricity transmission capability. Without new transmission lines, a 33 percent target for the Renewable Portfolio Standard (RPS) is unlikely to be met. Several recent developments are enhancing the likelihood that these new lines can be built by 2020. The Renewable Energy Transmission Initiative (RETI) is bringing together utilities, government agencies, renewable developers, the California ISO, environmental groups, land owners, and Native American representatives to identify the highest priority renewable energy zones and transmission paths to deliver electricity to urban areas. In addition, federal and State transmission corridor planning processes aim to reduce the time needed for permitting and environmental review of new transmission.

Equally important to building transmission is modernizing the transmission and electricity distribution system. Advanced control, communications, and metering technologies, as well as improvements in control of both conventional and renewable generation, can create a more reliable, resilient grid. Such a grid will better accommodate the addition of large amounts of

[38] For an extended discussion of the expected impacts of climate change in California, see the webpage for the Fifth Annual California Climate Change Research Conference sponsored by the California Energy Commission, California Environmental Protection Agency, and California Resources Agency, http://www.climatechange.ca.gov/events/2008_conference/indix.html.

utility-scale intermittent wind and solar generation and distribution-level renewable energy. Smart grid improvements will also facilitate the use of demand side resources (for example, automated load-shedding) to maintain system reliability in the face of both increased "ramping" from growing residential cooling loads in the summer and increased daily and seasonal variability in electricity generation.

Power plant permitting and AB 32

California's energy agencies have established a loading order for adding new resources to the electricity supply mix though the Energy Action Plan. The loading order specifies the new electricity supply resources will be added in the following order:

- increased conservation and energy efficiency to minimize increases in electricity and natural gas demand
- renewable energy resources and distributed generation
- additional clean, fossil fuel, central-station generation.

The Commissions also stated their support for improvements to the bulk electricity transmission grid and distribution facility infrastructure to support growing demand centers and the interconnection of new generation.

The CPUC has also established a 'carbon adder' as part of its process for reviewing procurement decisions by the state's investor-owned utilities. This adder, currently approximately $12.50 per short ton of CO_2[39], is intended to protect California's ratepayers from the financial risk associated with regulation of greenhouse gases in the future. The CPUC established this policy prior to adoption of AB 32, and this policy will help guide procurement decisions through the implementation process for AB 32.

While these policies make clear that the State's energy policy provides a strong foundation for the necessary transition to a low-carbon electricity supply, the existing permitting process for power plants in California does not allow these policies to take precedence. In part due to the decision under AB 1890 to eliminate the 'needs' test for new power plants being permitted by the California Energy Commission, permitting decisions on new fossil-fired power plants are no longer tied to consistency with the State's energy policies. Rather, the decisions on whether to apply for permits and whether to build permitted power plants are left to private developers. As the electricity market in California has changed through the years, this has resulted in a large number of power plants being proposed by developers that have either not been pursued through the permitting process or that have not been built after receiving a permit.

The Energy Commission, which has exclusive permitting authority for thermal power plants over 50 MW in California, is planning to initiate an investigation into how to better align its permitting process with the State's greenhouse gas and renewable energy policy goals. ARB intends to work closely with the Energy Commission during this proceeding. New power plants will be a critical part of the state's electricity mix in coming decades. Because the investments that are made in this new infrastructure in the next several years will become part of the backbone of the state's electricity supply for decades to come, this timely investigation will be a critical element of California's ability to meet both the AB 32 emission reduction target for 2020 and for the more ambitious target set by the Governor for 2050.

[39] Equivalent to approximately $13.80 per metric ton

GHG Reduction Strategies for 2020

Slowing global warming requires meeting energy needs with zero- or low-carbon energy sources. Two overarching strategies for obtaining GHG reductions from the energy sector are demand-side strategies that reduce energy use, and supply-side strategies that limit or reduce the emissions associated with electricity generation.

Reducing energy demand through energy efficiency and conservation will continue to be California's most cost-effective tool for achieving GHG reductions in the energy sector. While California's past achievements in energy efficiency are impressive, we need to do much more in order to meet the AB 32 greenhouse gas targets. California must take actions that reduce per capita energy demand *significantly faster* than the rate of population growth. Among other things, this will require: dramatic improvements in how we build our homes and the appliances we use; making significant improvements to existing buildings; and replacing or increasing the efficiency of existing appliances. Because of the urgent need to reduce energy consumption as much as possible, California must put renewed emphasis on motivating consumers to conserve by using energy wisely.

Emission reductions will also come from the supply side, through increased use of renewable energy and other forms of clean, distributed generation, and through measures that limit the use of electricity generated from high GHG sources. Existing programs and policies already lay the groundwork for renewable energy in California. The enhanced Renewables Portfolio Standard (RPS) recommended in this Plan and in the recent joint CPUC-CEC Proposed Final Opinion will require IOUs, ESPs, and CCAs to meet 33 percent of their electricity sales with qualifying renewable power, such as wind, solar, biomass, geothermal, and small-hydropower resources. Additional savings will come from California incentive programs for small-scale solar photovoltaic and solar water heater systems. By tapping into these existing policies and programs, increasing targets, and addressing key infrastructure barriers, California will achieve significant GHG reductions. Other GHG savings can be achieved by removing financial barriers and developing supportive policies for combined heat and power and other forms of clean, distributed generation.

Feed-in tariffs may well be an important mechanism to increase the pace of development of new CHP and RPS-eligible renewable energy. AB 1613 (Blakeslee, Chapter 713, Statutes of 2007) authorizes the OUC to require feed-in tariffs for combined heat and power under 20 MW. Feed-in tariffs are in use in 16 European countries and have had marked success in stimulating rapid increases in the proportion of total electricity generation supplied by renewable generation technologies, and are a significant part to the European Union's GHG emissions reduction efforts. Ontario has recently adopted a set of feed-in tariffs, and several states in the US have limited feed-in tariffs and/or are considering legislation to establish feed-in tariffs.

Activities related to feed-in tariffs for RPS-eligible renewable resources include the following:

- SCE offers a limited set of standard offer contracts for biomass generation under 20 MW.[40]

[40] Southern California Edison Company, Biomass Program, website at: http://www.sce.com/NR/rdonlyres/AAEFDE22-AFD9-49EE-86AB-4248EC31949C/0/080314_BSC_FAQ.pdf. This program is not a true feed in tariff. As stated in the program introduction on the SCE website, "SCE reserves the right to accept or reject any contract submitted to SCE for its approval and execution." Because the utility is not

- The CPUC has directed investor-owned utilities to offer a limited quantity (about 480 MW) of feed-in tariffs for RPS-eligible projects up to 1.5 MW.[41]
- The CPUC is considering expanding the use of feed-in tariffs for renewable energy under 20 MW.[42]
- Currently the Energy Commission is exploring possible further expansion of feed-in tariffs in the 2008 IEPR Update proceeding.

In addition, the EPS, and other potential measures that could reduce net GHG emissions from emissions-intensive fossil fuel power plants, can ensure that cleaner power is delivered to California consumers[43]. The EPS is existing law[44] that precludes California's electric utilities from making investments in, or entering long-term purchase contracts for, baseload electricity generation with very high GHG emissions. While technology and fuel neutral, the EPS effectively reduces emissions from imported, coal-generated electricity as current contracts expire and are not renewed. EPS regulations were adopted by the CPUC for investor-owned utilities and by the Energy Commission for publicly-owned utilities. Both commissions adopted a maximum allowable emissions standard of 1,100 lbs CO2 per megawatt-hour (MWh).These regulations prohibit California utilities from entering new contracts of more than five years with power plants that emit in excess of what a modern, efficient combined-cycle natural gas baseload power plant would emit. Existing coal plants cannot meet this standard. Carbon capture and sequestration (CCS) would almost certainly be required for coal generation to meet this standard. In the absence of cost-effective CCS or some other solution for coal, California's coal-intensive utilities must plan to replace electricity from coal plants with power from less carbon-intensive resources when existing contracts expire.

Emissions reductions required by SB 1368 are not considered a separate measure in the Scoping Plan. However, carbon-intensive electric utilities will be able to take advantage of these mandated reductions to minimize their need for allowances under cap and trade. Such utilities will need to plan to replace high carbon-generated electricity with energy efficiency, renewables, and, if necessary, less carbon-intensive fossil resources.

California's utilities have contracts and/or ownership arrangements with five out-of-state coal power plants that will either expire by 2020, or change such that less coal-generated electricity is

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required to take generation at an feed-in tariff rate, this kind of standard offer may do little to solve the problems faced by small renewable energy developers. However, the program has had some success. The expiration date for SCE's Standard Contract for Biomass is 12/31/2008 or 250 MW, whichever comes first. As of early June 2008, SCE has 11 MW under contract, 23 MW in negotiation, and 22 MW of inquiries. If SCE does not reach 250 MW by 12/31/2008, SCE may consider continuing to offer the contracts in 2009.

[41] The CPUC has two options for these feed-in tariffs: one is "full buy sell and RECs;"the second option is "sale of excess and RECs." For further details, see Decision 07-07-027 in Rulemaking 06-05-027.

[42] CPUC, June 5, 2008, "Amended scoping memo and ruling of assigned commissioner regarding Phase 2 of tariff and standard contract implementation for RPS generators," in CPUC Rulemaking 06-05-027, http://docs.cpuc.ca.gov/efile/RULC/83784.pdf, p,A-2 through A-5. Also see documents related to feed-in tariffs in the Energy Commission's 2008 IEPR proceeding, http://www.energy.ca.gov/2008_energypolicy/documents/index.html.

[43] Interstate commerce in electricity is federally regulated by FERC. The EPS regulations are technology and fuel neutral. To a large extent, FERC regulations have been generally technology and fuel neutral until recently.

[44] CCR §§2900-13 and PUC§§340-341, established by SB 1368 (Perata, Chapter 598, Statutes of 2006)

imported to serve California customers[45]. Expiration of and changes to these contracts will mean that, by 2020, California will reduce coal-based generation from imports by approximately 10,000 GWh, responsible for about 9.7 $MMTCO_2e$. The table below lists the specific coal plants and corresponding utilities that have contracts which will terminate by 2020:

- Intermountain Power Plant: LADWP, Riverside, Anaheim, Pasadena
- Navajo Generating Station: LADWP
- Boardman Plant: SDG&E, Turlock Irrigation District
- Deseret Plant: Riverside
- Reid Gardner Plant: Anaheim, Azuza, Redding, Imperial Irrigation District, Modesto, Silicon Valley Power, Department of Water Resources

Assuming that electricity from these plants is replaced with electricity from combined cycle natural gas, the EPS will reduce California's emissions from imported electricity by almost five million metric tons of CO2E emissions annually[46]. Larger reductions are possible if *renewable* electricity is used to replace coal power. However, it is important to note that leakage could be a problem if these plants, instead of reducing or ending production, merely sell coal-generated power to utilities in other states. This potential leakage could be mitigated under the anticipated regional, Western Climate Initiative (WCI) cap-and-trade system.

GHG Reduction Strategies for 2050

Looking beyond 2020, research and deployment of new technologies will play an essential role in delivering the technologies needed to change the way we generate and use energy. The Economic and Technology Advancement Advisory Committee recognized the importance of pursuing technologies that are transformative in nature.[47] Two of the technologies that they highlighted are "smart grids" and carbon capture and sequestration:

- **Smart Grids.** Today's power grid was designed primarily to transmit electricity from central generation source to the point of consumption. A "smart" and interactive grid and communication infrastructure would allow the two-way flow of energy and data needed for widespread deployment of distributed renewable generation resources, plug-in hybrids or electric vehicles, and end-use efficiency devices.[48] Smart grids can accommodate increasing amounts of distributed generation resources located near points of consumption, which reduce overall electricity system losses and corresponding GHG emissions. Such a system would allow distributed generation to become mainstream, and would support the use of plug-in electric vehicles as an energy storage device by charging at night and supplying electricity to the grid during peak hours. The two-way flow of energy and data would also

[45] Ownership structures or contracts for the output of coal plants are complex and varied. The Intermountain plant, which alone was responsible for 14 MMTCO2e of GHG emissions in 2007, is under arrangements in which 97 percent of its current electric output serves customers of publicly-owned California utilities that are members of the Southern California Power Pool Authority. Under inter-related contracts, the share from Intermountain going to California utilities will decrease to 75 percent by 2020. Data from the CEC.
[46] If some or all of the generation is replaced by renewable generation, there would be additional reductions in GHG emissions.
[47] http://www.arb.ca.gov/cc/etaac/ETAACFinalReport2-11-08.pdf
[48] The demand side actions would be accomplished through efficiency, conservation, and fuel substitution strategies discussed elsewhere in this document.

allow customers to respond to price signals, and give consumers the ability to lower their electricity bills by reducing demand during peak times. Improved demand response capabilities would in turn allow grid operators more flexibility in responding to fluctuations on the generation side, which can help alleviate the current difficulties with integrating intermittent resources such as wind.

- **Carbon capture and storage (CCS).** CCS is any process that "captures" CO_2 emissions and stores or sequesters them away from the atmosphere. Geologic sequestration involves using gas separation technologies to capture CO_2 from large point sources, such as power plants, cement factories, or refineries, and injecting it deep underground. While the likely rate of deployment of CCS may not yield substantial reductions before 2020, CCS within California and the Western Electricity Coordinating Council (WECC) region has the potential to play a significant role in helping to achieve the GHG goals for 2050.

To reduce emissions to the level needed by 2050, California needs to promote innovation that produces significant improvement in technology and infrastructure. Furthermore, we must ensure that the policies and technologies deployed over the next few years do not detract from the implementation of even more promising technologies that emerge in the future.

Economic Benefits

California can serve as a model for the nation by demonstrating that dramatic greenhouse gas reductions through energy measures are not only possible, but economically beneficial. Investments in energy efficiency are often highly cost-effective, and many consumers and businesses will find that it is possible to lessen their carbon footprint while simultaneously saving money. Other economic benefits will be gained as new energy technologies are developed to meet the climate change challenge. Investments in energy efficiency and clean energy technologies have been shown to provide numerous benefits on an economy-wide scale, by reducing the need for energy imports, cutting emissions and associated health-related costs, and creating high-paying jobs. As an added benefit of being a leader in clean energy technologies, many California companies will find that their technology innovations can be exported to other states and nations, creating additional jobs and other economic benefits that will ripple through the economy. Thus, there is no need to choose between the environment and the economy. We can create more jobs, reduce societal costs, *and* protect the environment by adopting policies that enhance energy efficiency and clean energy technologies. This can be accomplished through innovation and investment back into the California economy to stimulate the rigorous development of "green" industry.

Achieving these long-term benefits does not mean that customer rates for electricity and natural gas will not increase in the short term, even if overall system costs and average consumer energy bills, adjusted for inflation, are lower than they would have been with continued high consumption of fossil fuels. Modeling done as part of the CEC-CPUC joint AB 32 proceeding suggests that rates will increase significantly by 2020 in both a "business-as-usual" fossil fuel-intensive scenario or in scenarios based on high levels of efficiency and renewable energy. Increased rates in conjunction with reduced electricity or natural gas customer bills can result as energy efficiency is increased. This is because systems costs (transmission, distribution, and generation) will necessarily increase to meet population growth even as fewer kilowatt hours or therms are consumed. Thus, total costs are spread over fewer kilowatt hours or therms, leading to increased "per-energy-unit" rates. The costs of various potential future resource mixes for

electricity generation depend on many unknowns and are difficult to predict. Nonetheless, as demonstrated in California's previous energy efficiency and renewable energy investments, the numerous economic benefits from these programs can significantly outweigh the short-term costs.

This Plan is, in part, an initial look at economic costs and benefits of this and other recommended Emission Reduction Measures. ARB plans more detailed analysis to ensure that the overall AB 32 program does not have unreasonable near term costs and that small businesses, low-income communities, and all Californians share in the benefits.

Overlap with Other Sectors

The energy sector overlaps and intersects with many of the other GHG sectors discussed in the Scoping Plan. Because buildings use almost 70 percent of all electricity consumed in the state, green building measures hold promise for additional demand side energy reductions. Measures addressed in the Green Buildings and Local Government sections of the Scoping Plan therefore have significant implications for the electricity and natural gas sectors. Transportation is another area of significant crossover. Electricity and natural gas represent two alternative fuels for the transportation sector that are less GHG-intensive than gasoline or diesel, but shift emissions to the electricity and natural gas sectors. The Forest and Agricultural, and Recycling and Waste Sectors also offer GHG reduction measures that affect the Energy Sector. Biomass from forests or agricultural waste can be used as fuel for electricity production. Similarly, electricity can also be generated from landfill gas. In some cases, methane can be captured for direct injection into natural gas pipelines. The Water Sector is important as well. The conveyance, treatment, use, and disposal/recycling of water account for approximately one-fifth of the electricity and one-third of the non-power plant natural gas consumed in the State. Energy is also consumed through the use of water in buildings – for example, in water heaters and clothes washers. Not only can the Water Sector contribute to energy savings through water system and end use efficiency efforts, it can also support the development of renewable resources co-located with existing water-related infrastructure.

Recommended Actions

Cap-and-Trade Program

California is working closely with other states and provinces in the Western Climate Initiative (WCI) to design a regional cap-and-trade program that can deliver GHG reductions throughout the region. ARB will develop a cap-and-trade program for California that will link with the programs in the other WCI Partner states and provinces to create this regional market.

Consistent with the recommendations in the proposed decision issued September 12 by the CPUC and CEC[49], the WCI proposes to include the electric sector in the cap-and-trade program. As required under AB 32, California is examining the First Jurisdictional Deliverer as the point of regulation for the electric sector, ensuring that California and the WCI Partners cover

[49] Joint Agency proposed final opinion, *Final Opinion On Greenhouse Gas Regulatory Strategies*, September, 2008. The Executive Summary, Frequently Asked Questions, and a Joint Agency News Release summarizing the decision are available at: http://www.energy.ca.gov/ghg_emissions/index.html. The full text of the decision is available at: http://docs.cpuc.ca.gov/efile/PD/89317.pdf (CPUC website).

emissions from electricity generated in the Partner jurisdictions as well as emissions from electricity imported into the jurisdictions.

The WCI also proposes that emissions from residential, commercial, and industrial natural gas users be included in the cap-and trade program. Large users of natural gas would have a direct regulatory obligation under the program based on their facility emissions. WCI recommends that for small users (such as residential and commercial natural gas customers), the emissions be phased into the program, with the point of regulation being the natural gas local distribution companies (LDCs). These LDCs would have the compliance obligation under the cap-and-trade program.

Both mandated actions (such as compliance with the Emission Performance Standard for electricity generation) and voluntary actions (such as additional renewable generation beyond RPS requirements) will help some electric utilities and other capped entities stay under the cap. For example, under the EPS, utilities with coal contracts that expire before 2020 will not be able to enter new long-term contracts for coal-generated electricity without CCS. Thus, they will see a drop in emissions as imported coal power is replaced by renewable resources or less carbon intensive natural gas power. Although compliance with the EPS will not create offsets, changes in emissions resulting from existing law may help certain electric utilities meet their caps without buying allowances.

By setting a limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program will complement other regulatory measures for electricity and natural gas and achieve additional reductions in greenhouse gases within this sector.

(E-1 and CR-1) Energy Efficiency

Energy efficiency is first in California's "loading order" for meeting State electricity and natural gas needs, as expressed in the State's Energy Action Plan (EAP). The EAP, first adopted by the CPUC and CEC in 2003, represents a critical strategy for reducing this sector's GHG emissions. In order to meet our climate change goals, California must pursue very high levels of energy efficiency using more advanced approaches that go beyond traditional programs, standards, and delivery mechanisms.

This Plan sets statewide energy demand reduction targets of 32,000 GWh (E-1) and 800 million therms (CR-1) relative to business as usual projections for the year 2020.[50] These projected electricity and natural gas savings are based on the joint CPUC-CEC goal of achieving "all cost-

[50] The 32,000 GWh target is based on two reports: an IOU energy efficiency potential goals study done for the CPUC (Itron, prepared for CPUC, *Assistance in Updating the Energy Efficiency Savings Goals for 2012 and Beyond*, March 2008); and, a CEC report that projects potential energy efficiency savings for the POUs (California Energy Commission. *Achieving All Cost-Effective Energy Efficiency for California*, CEC-200-2007-019-SF, December, 2007.) The two energy agencies use somewhat different approaches to modeling their preferred policy scenarios for "all cost effective energy efficiency" combined with the 33 percent RPS goal. The CPUC and its contractor, E3, developed a "High Energy Efficiency and 33 Percent RPS" scenario, while CEC staff has used E3's model to develop a "100 Percent Economic Potential Energy Efficiency and 33 Percent RPS" scenario. Because they choose different economic assumptions for 2020, the agencies have used two different assumptions for 2020 energy efficiency potential in their scenarios. However, both assume energy efficiency potential at close to 32,000 GWh. In both agencies' scenarios, it is assumed that the 32,000 GWH of savings are net of about 15,000 GWh of energy efficiency believed to be "embedded" in the CEC's baseline demand forecast.

effective energy efficiency" as defined by a specific set of energy efficiency measures currently available "off the shelf." While aggressive, these targets do not comprise the full potential electricity and natural gas savings that would be achieved by 2020 if all energy efficiency strategies discussed below can be completely and successfully implemented. With strong success in all these strategies, ARB estimates potential energy efficiency savings of 40,000 GWh and over 1 billion therms relative to business as usual for 2020[51] could occur. This higher level of savings would better position California along the trajectory needed to meet the 2050 GHG reduction goal.

Achieving these levels of energy efficiency will require new approaches, now being developed, that go beyond building and appliance standards and beyond utility efficiency programs. The new paradigm needed for energy efficiency efforts will necessarily include groundbreaking activities across all economic sectors, leveraging past successes into new and bolder actions. It will require increased efforts, additional resources, commitments, and new levels of collaboration among state agencies such as the Building Standards Commission, the Department of Housing and Community Development, the

Twelve Strategies for Maximizing Energy Efficiency

Cross-cutting Strategy for Buildings

- *"Zero Net Energy" buildings*

Codes and Standards Strategies

- *More stringent building codes and appliance standards*
- Broader standards for new types of appliances and for water efficiency
- Improved compliance and enforcement for existing standards
- *Voluntary efficiency and green building targets beyond mandatory codes*

Strategies for Existing Buildings

- Voluntary and mandatory whole-building retrofits for existing buildings
- Innovative financing to overcome first-cost and split incentives for energy efficiency, on-site renewables, and high efficiency distributed generation

Existing and Improved Utility Program Strategies

- More aggressive utility programs to achieve long-term savings

Other Needed Strategies

- Water system and water use efficiency and conservation measures
- Local government programs that lead by example and tap local authority over planning, development, and code compliance
- Additional industrial and agricultural efficiency efforts
- Providing real time energy information to help consumers conserve and optimize energy performance

CEC, and the CPUC, as well as with investor-owned and publicly owned utilities, local governments, builders and property investors, and the manufacturers and installers of building

[51] Achieving the higher level of 40,000 GWh electricity savings would require additional actions not included in the Itron goals framework. Several of those actions, including water system electricity efficiency and consumer response to real time energy cost information, are among the strategies discussed in this section.

systems and equipment. Moreover, there must be equivalent efforts targeting owners and stakeholders serving our industrial and agricultural sectors. Beyond new technologies, better designs, and programs that facilitate improvements, California also can achieve GHG reductions through efforts that promote consumer awareness of and responsive action to manage energy costs and waste. If California is to capture maximum levels of energy efficiency, all of the 12 strategies listed in the preceding table, and additional strategies at earlier stages of development, will need to be aggressively implemented.

Discussed below are current efficiency strategies and new approaches that are needed to meet and exceed the recommended efficiency targets. For the new, more innovative strategies, specific efficiency programs are yet to be developed; however, meeting the minimum targets would likely require at least partial implementation of most of the energy efficiency strategies discussed below. In order to reach the higher projected efficiency potential, California would need to pursue these strategies more aggressively and completely. Following the discussion of the 12 strategies, this section discusses the need to continue research into advanced energy efficient technologies, systems and operations. The section concludes with an assessment of benefits and costs.

New energy efficiency strategies will target industrial, agricultural, commercial, and residential end-use sectors. For the building sector, new strategies include "zero net energy" (ZNE) buildings - a unifying concept that has been endorsed by both the CPUC and the Energy Commission in recent policy documents. California will need these new initiatives, strengthening of traditional building sector strategies of building standards and utility programs, and development of additional approaches to ensure leaving no efficiency opportunities overlooked.. All of the building strategies both support, and are enhanced by, the Green Building measures discussed elsewhere in Appendix C.

Cross-cutting Strategy for Buildings

"Zero Net Energy" (ZNE) buildings provide an overarching framework for building energy efficiency while providing the features and amenities consumers want in a home. Such buildings are extremely energy efficient and generate enough energy on-site[52] to completely offset the energy consumed within the building over the course of a year. ZNE buildings are a step toward carbon-neutral buildings; green building strategies for construction, demolition and waste management are also needed.

"Zero Net Energy" Buildings

The Big Bold Energy Efficiency strategies (BBEEs) for ZNE buildings proposed by the CPUC[53] and called for in the Energy Commission's 2007 policy report[54] would require all new residential and commercial buildings to use zero net energy by 2020 and 2030, respectively.

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[52] "Zero Net Energy" is not yet fully defined by the energy agencies. It may be possible for a building to rely on renewable energy generation from a nearby renewable, distributed generation facility and still meet the definition of zero net energy.

[53] These strategies were proposed by CPUC in 2007 and further developed in CPUC's draft Strategic Plan: CPUC, 2008. *California's Long Term Energy Efficiency Strategic Plan: Achieving Maximum Energy Savings in California for 2009 and Beyond*. http://docs.cpuc.ca.gov/efile/PD/86800.pdf

[54] California Energy Commission, *2007 Integrated Energy Policy Report*,CEC-100-2007-008-CMF, httpJc://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF.

In addition to employing on-site electricity generation, true ZNE buildings must either replace natural gas with renewable energy for space and water heating, or compensate for natural gas use by producing surplus electricity for sale into the grid. Although not yet a goal of the energy agencies or the legislature, it may be possible to retrofit some existing buildings to a level of ZNE, providing even greater potential for emissions reductions. There are several concepts that must become standard practice in order to reach the targets set for ZNE buildings:

- Intermediate targets and stretch goals
  In the 2007 Integrated Energy Policy Report, the CEC recommends increasing standards for new buildings and appliance in each new iteration of the standards through 2020. With each revision, standards will bring buildings closer to the ultimate ZNE goal, in support of the ZNE targets for new homes (2020) and new commercial buildings (2030) established by the CPUC. The CEC plans to speed progress toward these goals by providing options to builders in the forms of "tiers." The first tier will be the traditional mandatory standard that increases in stringency with every code cycle. Additional tiers will be voluntary and represent a "reach" or "stretch" goal for advanced levels of energy efficiency. Establishing these "beyond code" options for new buildings provides a mechanism for testing new building efficiency strategies, and it is the testing of these new strategies that provides a pathway to the betterment of subsequent minimum codes.

  In order to quickly advance building practices such that zero energy homes become mainstream by 2020, California must establish programs and targets that encourage builders to exceed minimum codes, as this will be the proving ground for new building technologies and strategies. There are several specific measures in the Green Buildings section that would require local jurisdictions to meet "beyond code" targets.

- Zero Energy Heating and/or Cooling Technologies (ZEH/C)
  In Europe, many communities and buildings are heated and cooled through zero- or near-zero emissions technologies and systems that combine multiple technologies. Foremost among these technologies are geothermal heat pumps, advanced solar thermal water heating, fuel cells, and absorption chillers that can use heat from various renewable and low-emission sources to provide the work energy to cool water. These technologies are often most cost effective at the community or campus scale, combined with district heating and cooling. The California Alternative Energy and Advanced Transportation Financing Authority recommends that all electric and gas utilities be required to establish performance based incentives for ZEH/C systems. The ARB believes that this may be a promising mechanism for achieving additional emissions reductions as the technologies are further developed and introduced into California.

- Integrated Design
  Integrated design is a comprehensive strategy for delivering energy-efficient, high performance buildings at little or no additional cost. The approach brings all relevant players (architects, engineers, construction professionals) together at the start of the project, to analyze and optimize building performance and cost from the earliest design stages. As simple and obvious as it sounds, integrated design is not the norm. Making this process the norm would require guidelines and training for both practicing professionals and emerging design professionals in architectural and engineering schools.

- Passive Solar Design
  Another strategy that supports ZNE buildings is passive solar design. With our current understanding of building systems, it is possible to design most buildings (particularly residential buildings) such that the energy required for heating and cooling is minimal or nil. Even in cities as hot as Phoenix, well-designed homes can be substantially cooled by intelligent use of shade, orientation, and appropriate building materials. Such buildings will also require less heating energy in the winter. Orienting buildings to face south allows the sun to provide free heating in the wintertime, while window overhangs, strategically placed landscaping, and minimizing windows along the west side prevent overheating in the summertime. Exposing or adding thermal mass to the building allows it to "store" energy in its walls and floors, thus enabling the temperature inside to remain at a comfortable level for most of the day. Using simple, time-honored passive solar design strategies, buildings can be made to require much less energy than they do today. Some of these design principles will be captured in the new building standards, but there is a gap in the knowledge base. In order to ensure that building designers understand these concepts, it may be necessary to require passive solar design as part of architectural programs, exams, and ongoing professional education credits.

- Enable Sales of Surplus Generation into the Grid
  Under current law, customers of electric utilities may receive incentives for installing solar photovoltaic systems and several other less common renewable energy systems. However, with a few exceptions, customers participating in the Million Solar Roofs programs cannot sell electricity into the grid if they produce more than they consume on an annualized basis. This is a significant disincentive that makes it difficult for homeowners and businesses to create true ZNE buildings, because a true ZNE building, in most cases, would need to offset gas usage by producing "surplus" or "excess" electricity. To encourage zero energy buildings, utilities should be required to purchase surplus electricity generation at a fair rate that takes into consideration the time-value of electricity, the costs of production, the grid benefits, and the environmental benefits of solar and other distributed renewable generation. The CEC's 2007 policy report recommends that the CEC and the CPUC "work together to establish an appropriate feed-in tariff for excess generation from customer-owned solar installations based on the RPSA market price referent and time of delivery adjustment." [55]

- Moving Toward Zero Net Energy Existing Buildings
  Existing buildings use far more energy than the relatively small number of new buildings built each year. Existing homes can approach becoming zero net energy homes through improvements that combine solar (for electricity, heating water, and/or space heating) with efficiency retrofits of lighting, heating, cooling and duct systems and building envelope improvements. A major challenge is addressing the many housing types built as construction styles changed over the decades. Carefully targeted comprehensive ZNE programs could test and prove the concept of ZNE, or close-to-ZNE existing homes, retrofitted with measures appropriate to various vintages, styles and types of construction.

  ZNE existing commercial buildings are more challenging. However, such buildings are possible through major efficiency improvements combined with significant on-site

[55] CEC, *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMF.

renewable generation. Alternatively, the combination of combined heat and power (CHP) systems and energy efficiency "makeovers" can significantly reduce the carbon footprint of existing commercial buildings.

Codes and Standards Strategies

Four of the twelve strategies listed above for electricity and natural gas are based on further development of the State's building and appliance energy efficiency codes and standards. These strategies will make standards more rigorous and will extend them to cover all energy used in buildings. In addition, increased focus on compliance and enforcement is needed. Finally, voluntary "tiers" above the minimum requirements will push technology development and mainstreaming, speeding progress toward reduced emissions. These strategies, along with an emphasis of on-site renewable energy, move California toward zero net energy buildings.

This section discusses current standards, recent changes in law and policy, and then specifically addresses the four strategies that will make building and appliance standards more effective in reducing GHG emissions to targeted levels by 2020.

Under California's Public Resources Code, the CEC is authorized to adopt and update Building Energy Efficiency Standards and Appliance Efficiency Regulations. Dating back to the mid-1990s, the IOUs efficiency programs have funded an important portion of the work to adopt tighter standards. These building and appliance standards are one of the most effective tools for achieving energy efficiency. Each successive version of the building and appliance standards requires new technologies and tighter performance standards, thereby generating new energy savings. By increasing the efficiency of buildings and appliances, the standards also help consumers and businesses save money on utility bills.

The building standards include both prescriptive and performance standards for new construction, and for alterations and additions to existing buildings. Alterations, especially to existing commercial buildings, are responsible for a significant part of the energy savings gained from the building standards. The CEC updates the standards at its discretion but typically on a three year cycle. The most recent update occurred in 2008, and several update cycles are expected to occur between now and 2020.

California's appliance standards improve the operation and efficiency of refrigerators, freezers, air conditioners, and other appliances. The Appliance Efficiency Regulations include standards for both federally-regulated appliances and non-federally-regulated appliances. The standards apply to appliances sold or offered for sale in California, with a few exceptions. As with the building standards, the CEC updates the appliance standards at its discretion. The CEC adopted the most recent appliance standards in 2007 and expects to go through several more update cycles between now and 2020.

By law, the building and appliance standards must be cost effective, when taken in their entirety and amortized over the economic life of the structure and/or appliance. The CEC includes an estimate of "avoided costs" as part of this life cycle cost analysis. Future iterations of the standards will incorporate updated fuel prices and a "carbon adder" in the calculation of avoided costs, and may also account for the likelihood that the installed cost of energy efficient technologies will decline with increased market penetration and resulting economies of scale.

Thus, future standards are expected to include a more accurate representation of the types of measures that are truly cost effective in today's world.

All of the technologies utilized to implement these energy efficiency standards are considered "off the shelf" in that they are readily available in the marketplace. As part of the process of updating the standards, the CEC evaluates new and emerging technology for possible inclusion in the next iteration. For the building standards, the CEC administers an ongoing "compliance option" process that evaluates what compliance credit should be approved for new technologies. Once a compliance option has been in existence for a period of time, the CEC considers whether it should be added to the standards. In that way, the compliance option offers a testing ground for new technologies and a pathway to becoming part of the standards. The CEC's Buildings and Appliances Office also works with the Public Interest Energy Research (PIER) program and the utility efficiency programs to identify promising new technologies for possible inclusion in the standards.

Recent policies have placed priority on and established specific goals for updates to the standards:

- The California Green Building Initiative (Executive Order S-20-04) calls for a 20 percent energy efficiency improvement in nonresidential building standards by 2015.
- The West Coast Governors' Global Warming Initiative established joint commitments for the States of Washington, Oregon, and California to improve their building energy codes (both residential and nonresidential) by 15 percent by 2015.
- The Energy Action Plan and the Integrated Energy Policy Report call for ongoing updates to the standards that meet energy efficiency goals, address demand response, and promote the combination of solar photovoltaics and high energy efficiency buildings.
- Zero Net Energy goals, discussed above, have been established by the CPUC and CEC for all new residential and commercial construction. Significant changes to the building and appliance standards will be required if California is to meet these targets on a statewide basis.
- Assembly Bill 662 (Ruskin, Chapter 531, statutes of 2007), AB 1881 (Laird, Chapter 559, Statutes of 2006), and AB 1560 (Huffman, Chapter 532, Statutes of 2007) give the CEC authority to regulate water efficiency. This legislation allows the CEC to develop efficiency standards that apply to both indoor and outdoor water use.
- Assembly Bill 1109 (Huffman, Chapter 534, statutes of 2007) requires the CEC to adopt minimum energy efficiency standards for general purpose lighting, to reduce electricity consumption 50 percent for indoor residential lighting and 25 percent for indoor commercial lighting.

In addition to the background and recent policy changes discussed above, the following four strategies, already under development at the Energy Commission, will play an extremely important role in meeting the 2020 electricity and natural gas energy efficiency targets. Thus, they are critical to achieving CO2e reduction goals.

More stringent building codes and appliance standards

The Energy Commission regularly updates building and appliance standards, but past iterations have not yet set a path to zero net energy. To achieve emission reduction goals, each new iteration of standards must aggressively ratchet down building energy use, and must ultimately require on-site renewable energy production. The CPUC's Energy Efficiency Strategic Plan recommends progressive advances toward zero with each generation of standards.

Because energy efficiency is more cost-effective than on-site renewable generation, a measure of success will be how close good design can approach zero energy, minimizing the need for on-site generation.

Broader standards for new types of appliances and for water efficiency

Current appliance standards cover a limited set of appliances and energy systems. Many consumer products that are not currently subject to California energy efficiency requirements offer significant potential for efficiency improvements. Standards must be broadened to cover all devices using significant amounts of energy, and, as required by Assembly Bill 662, AB 1881, and AB 1560, standards for water efficiency must also be set.[56]

The Energy Commission is expanding appliance standards to cover consumer electronics, a growing source of energy demand that has not previously been addressed by the standards. In addition, the Energy Commission is moving rapidly to cover other building "plug loads" such as small home appliances, and office computers and equipment. Other energy using devices, from plasma televisions to internal power supplies must eventually be covered to enable zero net energy new and existing buildings. Furthermore, new integrated systems, such as solar assisted space and water heating, need to be incorporated among the choices available to meet building performance requirements.

Future appliance standards should address the energy consumption of electronic devices that offer significant potential for efficiency improvements, such as flat screen TVs, computers, and portable electronics that with rechargeable batteries. These new "appliances" represent a significant (estimated at 15 percent) and growing portion of the overall energy use within a home. As an example, depending on technology developments and market penetration rates, future standards proposed by PG&E[57] for plasma and LCD TVs may be able to save approximately 6,500 GWh per year compared to what these devices would use without standards.

For some appliances, federal law preempts State authority to set more aggressive standards. (The federal government may grant waivers from preemption, but the legal criteria for waivers are stringent and so far the U.S. Department of Energy has been unwilling to grant them.) However, California is exploring whether regulation of appliance efficiency through the state's performance-

New Heating Technologies

Technology improvements which increase the energy efficiency of gas-fired water and space heaters continue to be developed. Condensing heaters, tankless gas-fired on-demand heaters and other super efficient gas-fired heating appliances will replace less efficient water and space heaters by attrition as they fail. As transitional technologies, these will, in turn, be replaced by carbon-free solar and new technologies as they reach the end of their life. The transition to carbon-free heating systems will occur over several decades.

[56] Assembly Bill 662, (Ruskin, Chapter 531, Statutes of 2007) gives the Energy Commission authority to set water efficiency standards.

[57] Energy Solutions, Codes and Standards Enhancement (CASE) Initiative For PY2008: Title 20 Standards Development: Analysis of Standards Options for Televisions (Revised Proposal), prepared for PG&E, July, 2008. Available online at: http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-07-16_workshop/proposals/PGE_Revised_Television_Proposal.pdf

based building standards can avoid some of the worst restrictions of federal law.

Further analysis is needed regarding the interaction of expanded use of plug-in vehicles, zero net energy homes, and remote renewable energy generation. While zero-net energy homes can reduce peak demand for afternoon off-site energy in California (usually met with fossil-fuel generation), increasing the night-time electricity load through plug-in electric vehicles could help utilize night-time renewable energy from remote, utility-scale wind generators.

Improved compliance and enforcement for existing standards

Lack of compliance and enforcement of building and appliance energy standards has been identified as a significant barrier, especially in the application of standards to remodels and retrofits. The Energy Commission is beginning to increase its compliance activities, but more is needed. Additional state resources for compliance would enable the State to work more thoroughly with a greater number of local governments. This is important because local governments have the primary responsibility for building code enforcement, yet need additional support to be more effective in enforcing compliance with energy standards. The State could assist local governments with additional training activities for local building department inspectors and plan checkers, training for contractors and builders, training for energy related trades (e.g., plumbers, electricians, controls technicians and engineers). The state could also support enforcement activities by developing and providing to localities information on best practices for energy efficiency code enforcement. Furthermore, the CEC is in the process of streamlining compliance verification tools and mechanisms; additional work may be needed in this area if resources are available. Work in this area will need to fully involve local government building departments, utilities, the Building Standards Commission, the Department of Housing and Community Development, home and building raters and rating organizations, builders and designers, and other private and non-profit stakeholders.

Voluntary targets for efficiency and green buildings beyond mandatory codes

State building energy standards set minimum acceptable levels of building performance. To drive innovation and rapid growth of the best new technologies, it is important to encourage builders to go “beyond code.” There are a variety of mechanisms for doing this. First, there are the high efficiency “tiers” established by the Energy Commission, currently required for new homes that receive solar incentives. To receive solar incentives, a building must be 15 percent (tier 1) above standards. Meeting the second tier (35 percent above standards) brings additional benefits to the owner or builder.

Second, the Buildings Standards Commission, working with the Green Building community, has developed voluntary green building standards that have energy requirements beyond current code, as well as other green building measures. Much of the current voluntary green building code will become mandatory in 2010. However, new, tighter voluntary green building standards must also be developed as previous iterations become mandatory. Voluntary codes can push improvements in “state-of-the-art” techniques leading to new best practices for sustainable, low-carbon building design and construction.

The Building Standards Commission and the Department Housing and Community Development, working with the CEC and green building community, must develop and regularly tighten voluntary standards written in code language that push the frontier of building best practices. Such voluntary standards can be made mandatory by local jurisdictions where they can

be tested and proven for later adoption into state mandatory standards, without creating disparate local standards that make builder compliance difficult. Voluntary and mandatory green buildings standards are discussed in detail in the green building section.

Strategies for Existing Buildings

Voluntary and mandatory whole-building retrofits for existing buildings

Because most of California's older buildings were built to lesser or non-existent building efficiency standards, improving the energy efficiency of existing residential and commercial buildings in California could produce substantial GHG benefits. In fact, improving the efficiency of California's existing building stocks is the single most important activity to reduced GHG emissions within the electricity and natural gas sectors. The CPUC's Energy Efficiency Strategic Plan[58] addresses the need for whole-house energy retrofits and establishes goals for reducing energy consumption in existing homes by 20 percent by 2015 and 40 percent by 2020. Consistent with these goals, ARB recommends establishing an environmental performance rating system for existing homes,[59] and adopting mechanisms to encourage and require retrofits for existing buildings that do not meet minimum standards of performance.

Besides the overall targets for existing buildings set in the energy efficiency strategic plan, the CPUC specifically targets additional, more comprehensive energy efficiency services for the 30 percent of California residences that qualify for low-income programs. The CPUC's vision is to transform the existing Low Income Energy Efficiency (LIEE) program to include both comprehensive retrofits and education to help residents use best practices for conservation and prudent, effective, energy system operation.

It is important to note that many of the Title 24 and Title 20 building and appliance energy efficiency standards currently apply to existing buildings. Appliance standards are applicable to all appliances sold in the state. Building design standards apply to retrofits, remodels and renovations in most cases, for both residential and commercial buildings. To gain the benefits of efficiency improvements in existing buildings, "trigger events," such as the sale of a building, should initiate voluntary and mandatory efficiency improvements that modernize building stock and reduce energy costs. Many local governments currently, or in the past, have experimented with, or are continuing to enforce, triggered mandatory building energy upgrades.[60]

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[58] CPUC, 2008. *California's Long Term Energy Efficiency Strategic Plan: Achieving Maximum Energy Savings in California for 2009 and Beyond*.

[59] This environmental performance rating system could be developed based on the California Energy Commission's Home Energy Rating System which is currently used for new homes, with input from the green building community, real estate agents, and other stakeholders.

[60] San Francisco, Berkeley, Davis, Santa Monica and many other cities had, or now have, limited residential and/or commercial retrofit requirements that are mandatory at time of sale or at other "trigger events." These programs, initiated in the 1970s and 1980s, are the source of "lessons learned" that can be considered as local jurisdictions plan their climate change activities. Typically residential mandates are known as "RECOs" (Residential Energy Conservation Ordinance) and correspondingly, commercial ordinances are called "CECOs."

Achieving or exceeding targeted levels of efficiency in existing buildings can be accomplished through a combination of aggressive utility, local government, and "set-aside" programs, incentives, the establishment and mandatory disclosure of environmental performance ratings for buildings, and time-of-sale environmental performance requirements. Additional information on efficiency measures for existing buildings is included in the Green Building section.

Implementing Recent Legislation and Policy Affecting Existing Buildings

- The 2007 *Guidelines for California's Solar Electric Incentives Programs* includes an eligibility criteria requirement for existing commercial buildings to receive an energy benchmark when a solar electric (PV) system will be installed. The intent of this requirement is for all cost-effective energy efficiency options to be considered before an investment in renewable energy is made. Understanding how a building's energy use compares to its peers is an important first step to identifying appropriate efficiency improvements.
- AB 1103 (Saldana, Chapter 533, Statutes of 2007) requires energy use benchmarking and disclosure by all commercial building owners to prospective buyers, lessees, or lenders starting January 1, 2010. The intent of this legislation is to include energy performance in the building's valuation at the time of a financial transaction. This could create a regional voluntary market for efficient buildings by including energy performance in the disclosures used to comparatively rate real estate properties.

Innovative financing to overcome first-cost and split incentives for energy efficiency, on-site renewables, and high efficiency distributed generation

As discussed below in the Green Building section, it is crucial that aggressive energy efficiency measures be accompanied by better financing alternatives. While energy efficiency is typically cost effective over the life of a building, building owners cannot always manage the up-front cost of these investments. For new or resale homes, a small number of lenders already offer "energy efficient mortgages" that allow the buyer to qualify for a larger loan if the home is energy efficient. In order for such offerings to become standard, lenders and appraisers alike could be required to factor the energy saving features of a home into their estimates of the home value and monthly utility bill outlay. In an energy efficient home, the utility bills will be much lower, and these bill reductions can more-than-offset the increase in mortgage payments. For homes undergoing an energy efficient retrofit, creative funding strategies like on-bill financing (offered by utilities or a third party) can allow the building owner to implement improvements without having to front the initial investment. As with the energy efficient mortgage, these financing mechanisms would allow the homeowner to pay off the investment with utility bill savings over time.

ARB and other State agencies will explore innovative financing options to help building owners spread the costs over the lifetime of the building and allow the measures to more than pay for themselves. Local governments have been pioneers in this area; Governor Schwarzenegger recently signed legislation[61] that allows any city to provide loans for energy efficiency and solar installations that may be repaid through tax assessments.

[61] AB 811 (Levine), Chapter 159, Statutes of 2008. This mechanism, based in part on a recent City of Berkeley ordinance, allows the cost of building improvements to stay with the building, and should help reduce the reluctance

To offer multiple options and give consumers choices, efforts to expand efficiency financing mechanisms would require coordinated action by private lenders, local governments, and many State agencies including the Business, Transportation and Housing Agency, the State and Consumer Services Agency, the Public Utilities Commission, the California Energy Commission, and the Department of General Services. Public-private partnerships also show promise; the City of Berkeley is considering partnering with private lenders to offer energy-related loans.

Building owners who install on-site solar generation currently have access to incentives under the Million Solar Roofs initiatives. In 2006, legislation was passed to establish the California Solar Initiative (CSI), discussed in detail under the Million Solar Roofs section of this Appendix. Currently, this program allows building owners to install just enough renewable generation to meet their annual load. However, many buildings have the potential to produce surplus electricity beyond that used on-site. Currently there is no financial mechanism for homeowners or commercial building owners to be compensated for producing additional renewable electricity. Creating an appropriate mechanism for compensation for surplus electricity would encourage additional zero energy new and existing buildings and would reduce demand for conventional electricity produced from fossil fuels.

Existing and Improved Utility Program Strategies

California's electric and gas utilities all offer, to various degrees, programs designed to reduce the gas and electric demand of the residential, commercial, industrial and agricultural customers they serve. Many of the programs use a combination of education, technical assistance and financial incentives to help consumers save energy. Utility programs will need to be strengthened and reconfigured to address all building energy systems more comprehensively. To maximize industrial energy efficiency, utility industry programs would need to be better targeted toward particular industry's needs, while being enlarged to cover more industrial sectors. The CPUC strategic plan, envisions energy efficiency provided by many other actors in addition to utilities, while also recommending many important changes that can inform a new generation of utility and non-utility programs.

Utilities – both investor-owned and publicly-owned – will continue to play a central role in developing and implementing energy efficiency programs, and will be expected to achieve higher efficiency targets than in the past. Innovation in energy efficiency delivery methods that deliver comprehensive building retrofits is needed. The "third-party" energy efficiency programs and utility-local government partnerships have pioneered comprehensive small business retrofits. Similar residential programs must be developed that leverage local resources to achieve maximum block-by-block participation while targeting all home energy systems, rather than just the "low hanging fruit."

This section discusses existing utility programs of both investor-owned and public utilities (IOUs and POUs), and also recommends changes to make programs more effective.

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of current owners, be they occupants or landlords, to make improvements that will produce benefits for subsequent owners.

More aggressive utility programs to achieve long-term savings

IOU Programs. The Investor Owned Utility (IOU) programs were initially funded exclusively through an electric Public Goods Charge and a natural gas Demand Side Management charge on customers' bills, capped at $228 million per year for electricity and $45 million gas, respectively. As of 2006-08, the efficiency budgets were greatly expanded, with more than half of the funding for efficiency coming from the utilities procurement budgets (funds used to contract for energy supplies) based upon cost effectiveness tests. These energy efficiency programs typically include discounts or rebates for the purchase or installation of efficient appliances, custom projects for large commercial and industrial processes, consumer awareness campaigns, energy audits, and other demand-side management efforts. The CPUC approves each utility's plan for efficiency programs every three years, which the utility implements with CPUC oversight. A number of programs are also coordinated on a statewide basis.

During the course of planning for energy efficiency programs the CPUC establishes a level of energy efficiency that is termed "economic potential." This level of efficiency potential is considered a theoretical maximum savings for which the value of the energy saved exceeds the theoretical total societal cost[62].

Annual savings targets for IOU energy efficiency programs that run through the year 2011 are currently designed to capture approximately 70 percent of the economic potential identified for that period. In 2008 the CPUC adopted longer-term goals through 2020 to lead the development of longer-term program strategies and, keeping in mind the 2020 initial target for California's GHG reductions under AB 32. The adoption in 2009 of utility efficiency portfolio plans for 2009-2011 is expected to reflect a mix of proven program designs and implementation strategies in combination with approaches to solicit new, innovative designs and savings technologies to enhance overall portfolio performance, both in the short- and long-term.

The CPUC recently adopted a "risk-reward mechanism" to bolster incentives towards achieving these targets. Under the new framework, IOUs earn an increased return on energy efficiency investments if they achieve at least 85 percent of their efficiency target, or face economic penalties if they achieve less than 65 percent of the target.

In addition, the CPUC working with the CEC, California's IOUs and numerous stakeholders, prepared the Long Term Energy Efficiency Strategic Plan scheduled to be adopted by the CPUC on September 18, 2008. This long-term plan offers unprecedented scope, vision and action targets to achieve very high levels of efficiency that can be integrated well with aggressive objectives for demand response and renewable distributed generation. It recommends strategies that can enable the utilities and other actors to achieve energy efficiency goals for the 2009-2020 period and beyond, contributing ignorantly to the State's AB 32 goals. It outlines key strategies

[62] The current theoretical economic potential, for IOUs only, is analyzed in the draft final California Energy Efficiency Potential Study, published in May 2008 and available at http://www.calmac.org/publications/PG&E_EE_FcstModelReport_DraftFinal.pdf This study was prepared for PG&E and other IOUs by consulting firms Itron and KEMA. Because the study includes only a limited set of energy efficiency technology measures, most of which are in incentivized in currentIOU energy efficiency programs, it does not provide a full analysis of potential energy efficiency. Some of the strategies proposed in this Plan, and in the CPUC's Long Term Energy Efficiency Strategic Plan, and under consideration for upcoming codes and standards, go beyond what was considered in the Itron-KEMA report to the IOUs.

and actions by IOUs, California agencies, businesses, research institutes and other entities necessary to achieve energy efficiency savings goals for 2020 that surpass the aggressive ten-year targets adopted by the CPUC in 2004 . Two crucial targets adopted by the CPUC, and supported by the CEC, are as follows:

1. By 2020, all new residential buildings will be zero net energy[63]; and
2. By 2030, all new commercial buildings will be zero net energy.

An third goal developed jointly by CEC and CPUC staff, is to transform California's Heating, Ventilation, and Air Conditioning (HVAC) practices, technologies, and industry such that HVAC systems installed in California are optimized to California's climate, properly sized, highly energy efficient, and effective at reducing peak demand for electricity. A fourth goal of the long-term energy efficiency plan is that all eligible low-income customers should have an opportunity to participate fully in the low income energy efficiency programs, and should be provided all cost-effective efficiency measures for their residences by 2020. The strategic plan includes many other goals and strategies, targeting industrial and agricultural sectors as well as buildings.

To achieve these goals, existing IOU programs will be increasingly coordinated with other state programs, such as building and appliance codes and standards programs, emerging technology programs, local government programs, and clean energy workforce development and training efforts. New programs, to be offered by other actors and/or utilities, will need to be expanded or developed, such as benchmarking building energy use and rating and labeling buildings, certifying industrial facilities for their energy management practices, local or state mandatory retrofit or retro-commissioning programs, and improved low or no-cost financing for energy efficiency improvements. Additionally, clean energy marketing and education programs will be linked with other statewide programs and ongoing AB 32 implementation activities. While the long-term benefits of these programs outweigh their costs, some programs could create short-term costs that result in customer rate increases.

POU programs. There are important differences between IOUs and POUs (and among POUs) that affect their ability to fund and affect energy efficiency within their territories. POUs account for 25 percent of the electricity provided in California, but only 5 percent of the utility efficiency savings total. This is primarily because up until the last decade, POUs were not required to invest in energy efficiency, the result being that most POUs have relatively little experience in this area. Also, some POUs are very small and simply do not have the staff to implement efficiency programs. The two largest POUs in the state – SMUD and the LADWP – have had energy efficiency programs for many years. SMUD has had more aggressive and successful energy efficiency programs than most other large POUs. SMUD and LADWP together account for about 60 percent of the POU savings. SMUD's savings are significantly larger than LADWP's savings in proportion to each utility's market share.[64]

[63] The CPUC has defined "Zero Net Energy" as the implementation of a combination of building energy efficiency design features and on-site clean distributed generation that result in no net purchases from the electricity or gas grid, at the level of a single "project" seeking development entitlements and building code permits.

[64] California Municipal Utilities Association, December 2006, *Energy Efficiency in California's Public Power Sector: A Status Report*.

AB 1890 (Brulte, Chapter 854, Statues of 1996) required the POUs to implement a non-bypassable surcharge to fund public benefit programs, with total funding percentages set at a level similar to those of the IOUs. Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) obligates the CEC to develop statewide estimates of energy efficiency and demand reduction potential, and to establish energy savings targets for the POUs. The CEC is required by law to report POU program investments and savings to the Legislature and the POU governing boards, but AB 2021 does not mandate the POUs to meet their energy savings targets. Further, no statutory requirements currently exist for ESPs or CCAs to invest in energy efficiency for their customers, though their customers fund a portion of the IOU energy efficiency programs through their distribution charges and are currently eligible to participate in IOU-administered energy efficiency programs.

The CPUC and CEC have recommended that ARB adopt mandatory minimum levels of cost effective energy efficiency savings for POUs, consistent with the programs and goals adopted by the CPUC for IOUs.[65] ARB supports the establishment of mandatory levels of energy efficiency for POUs.

Utility Energy Efficiency Programs Overall. While achieving energy efficiency savings exceeding current levels is possible, capturing such savings by way of voluntary incentive programs of the sort typically run by utilities will become difficult over time, as achievement of existing goals themselves will require unprecedented rates of program success. Increasingly, additional energy efficiency will necessitate more stringent codes and standards, innovative means of delivery, and technological innovations.

Much of the current technology utilized to implement utility efficiency programs such as compact fluorescent light bulbs and efficient refrigeration are considered "off the shelf," meaning they are readily available in the marketplace. However, until these technologies become mainstream in the market, they often require incentives to be price-competitive with older less efficient technologies. Upstream incentives or rebates are designed to promote market adoption, acceptance and, ultimately, market transformation. As market penetration is achieved, incentives for some technologies can be reduced or dropped completely. This "market transformation" is best maintained by incorporating the high efficiency technologies into mandatory building codes and appliance standards. In addition, many larger business and institutional customers use IOU energy efficiency incentive funds to implement custom on-site measures such as installation of efficient boilers, HVAC systems, and overall energy management tools. Without incentive funds, many of these types of installations would not be deemed cost-effective by customers in the near term, even though the payback may occur in as little as three to seven years.

Other Needed Strategies

Water system and water use efficiency and conservation measures

Large amounts of energy are required for the conveyance, treatment, use, and the disposal or recycling of water. The Water section of the Scoping Plan provides detail on needed strategies and actions, and recommends four measures related to energy efficiency. One of these, Water System Energy Efficiency (W-3) sets a target of reducing water-related energy usage by 20

[65] CPUC and CEC Joint Agency Decision, March 2008, *Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*, CEC-100-2008-002-F

percent, or approximately 4,400 GWh. The other three (Water use Efficiency, Water Recycling, and Reuse of Urban Runoff – measures W-1, W-2 and W-4) are water supply reliability measures and will help the State meet increased demand for water from population and economic growth. All four measures contribute to the overall energy efficiency goal.

Local government programs that lead by example and tap local authority over planning, development, and code compliance

California has over 600 local governments, including cities, counties and special districts. They are diverse in size, in economic base and in their approaches to energy efficiency. Some have been leaders in energy efficiency and renewable energy since the 1970s. Many more local governments and their communities are paying significant attention to climate change and doing what they can to develop and take action on aggressive GHG reduction targets. Because local governments have significant regulatory authority over building design and construction, and are responsible for enforcing the state's Title 24 and Title 20 energy efficiency building codes, they are in a strong position to promote energy efficiency. Local governments have also been leaders in promoting green building, water use efficiency reduced use of water in buildings and landscaping.

The Energy Commission, since the 1970s, has provided financial and technical assistance to help local governments retrofit buildings for energy efficiency, and design and build new efficient, green buildings. Since 2004, the investor-owned utilities have been formally partnering with local governments to improve the reach and efficacy of energy efficiency efforts by involving local communities. Public utilities are using similar strategies with communities in their jurisdictions. Other communities are in the process of becoming Community Choice Aggregators[66], a strategy they may use to more aggressively pursue local GHG reduction targets primarily through energy efficiency and community-scale renewables.

Local governments have a history of adopting local energy ordinances that may go beyond state minimum standards. By routinely updating statewide voluntary (or "stretch") green building standards in code language, the state can make it convenient for many more localities to raise the bar for construction and retrofits in their jurisdictions by adopting the state voluntary codes as mandatory within their jurisdictions. These jurisdictions can serve as proving grounds for advanced energy efficiency solutions that are close to being incorporated into statewide energy standards.

Other roles for local government include educating their constituencies and businesses about climate change and energy efficiency actions, setting an example by ensuring the public buildings are green and efficient, and integrating energy efficiency into community development and redevelopment programs.

Cities, counties, and special districts are likely to play an increasingly important role in delivering energy efficiency programs to the public. Additional detail on local government

[66] Community Choice Aggregators, of CCAs, are local governments or joint power authorities that elect to serve as the default provider of electricity commodity (generation) over wires owned by utilities. CCAs gain access to a proportional share of public goods charge funds paid by their customers and implement their own energy efficiency and renewable energy programs under the auspices of the CPUC.

potential and current activities is included in the Local Government and Green Building sections of the Scoping Plan and the appendices.

Additional industrial and agricultural efficiency efforts

Support to industry must focus on integrated business solutions that minimize costs and optimize total impact by addressing on-site GHGs, electricity use, criteria pollutants, waste management, water management and industrial process efficiency. The food processing industry has proposed a pilot demonstration project along those lines that could be undertaken in 2009.[67] Increased profits and public rankings for corporate social/environmental responsibility both can be major motivations for action. Typically both must be supported by centralized technical and regulatory assistance – a one stop clearinghouse with industry-specific information -- could provide information on emerging technologies, and leverage USDOE and USEPA research. Some public utilities – Silicon Valley Power is a prominent example – are targeting specific local industries such as data centers and semiconductor manufacturers, and can serve as models for industry specific programs.

Like industry, agriculture can be challenged to meet environmental regulations from multiple agencies. The CPUC's strategic plan recognizes that coordinated assistance is needed to help agricultural energy consumers manage energy, air, waste and water resources in the face of potential reduced water availability. The DWR's 2005 Water Plan Update also recognizes the opportunity to improve agriculture's water use efficiency practices which could help lower energy demand for pumping. Specific programs warranting coordination include the Energy Commission's research in agricultural water use and process efficiency, local air quality improvement funds, federal tax credits, and the federal Rural Energy for America (REAP) program.

Providing real time energy information to help consumers conserve and optimize energy performance

Except for specific advanced metering and real time pricing pilot programs, the current electricity metering system provides insufficient information to motivate commercial and industrial electricity users to conserve. Similarly, on the residential side, several pilot programs have shown display information on energy use and cost can help citizens achieve meaningful conservation in their homes. Automated price signals combined with voluntary automated demand response can help commercial and industrial customers save money, reduce unnecessary usage, and make the electric system more reliable. The most successful parts of pilot real time energy information projects must be mainstreamed to achieve their full potential, Furthermore, additional improvements are needed to maximize emissions reductions from advances in metering and communications technologies.

Because informed consumers make better energy decisions, efforts to help consumers make the connection between their actions, their utility bills, and their environment play an important role in achieving California's energy reduction targets. Building upon the past successful efforts of the Flex Your Power campaign, the CPUC has authorized a statewide energy awareness campaign to motivate consumers to conserve energy and to invest in energy efficiency.[68]

[67] CPUC Energy Efficiency Strategic Plan, page 39.
[68] CPUC Decision 07-10-032, October 18, 2007, p. 57.

Even more powerful than education campaigns, however, is energy-use feedback provided to consumers via in-home displays. Providing feedback on how daily activities in the house translate to energy costs is a simple concept that empowers consumers to take control of their utility bills. These devices relay information about energy consumption and energy costs to the consumer on a real-time basis and have been shown to induce conservation. An Emerging Technologies Report prepared for the American Council for an Energy Efficient Economy surveyed the results from roughly 20 studies on energy use feedback over the past 35 years and found energy savings ranging from four percent and 15 percent.[69] The authors chose five percent as a reasonably reliable and conservative estimate of expected energy savings from the use of energy displays, based on a 2004–2005 controlled pilot study by Hydro One in Canada.[70] Based on this research, it is reasonable to assume that the installation of energy use displays could cause consumers to reduce their energy use by five percent on average. This response would be above and beyond the typical consumer response to energy price.

Energy use monitors have three basic components: a sensor that collects energy use data from the meter or circuit panel, a wall or desk-mounted display, and a means of communication between the two. After collecting demand data from the meter, the devices can display both instantaneous power usage and cumulative energy usage over selected time periods; in some cases, the device can also provide projected energy use and cost estimates and even show other home diagnostic data such as temperature, humidity, and estimated greenhouse gas emissions.[71]

California could require that all new homes come equipped with an energy use display that provides real-time feedback to occupants on whole-house electricity consumption, electricity production (for homes with rooftop solar installations), and if possible, natural gas and water use. For existing homes, these devices or other information feedback mechanisms could be required for installation at time-of-sale or upon installation of a new HVAC system.

While there are home energy-use displays currently on the market, the technology is still relatively new and can be improved in terms of ease of installation, ease-of-use, and integration with other home systems such as thermostats, gas use, and possibly water use as well. California could set performance standards for these technologies and work with manufacturers to develop, test, and demonstrate display systems for use in a wide variety of homes (i.e. homes that may have different metering infrastructure).

Tapping into Emerging Technologies

The CEC's Public Interest Energy Research (PIER) program and the IOU Codes and Standards Support programs promote research, development and demonstration of new and emerging energy savings technologies. To achieve increased savings, emerging technologies would need to be more rapidly brought into utility incentive programs, and into voluntary and then mandatory standards.

PIER currently is planning solicitations for research and development projects that address zero energy new and existing buildings, buildings systems integration, and best practices training

[69] http://www.aceee.org/emertech/2006_EnergyDisplays.pdf
[70] In the Hydro One pilot project, the utility provided no energy savings guidance and still achieved aggregate savings of 5% in base-load electricity that persisted over the 18-month test period.
[71] http://www.aceee.org/emertech/2006_EnergyDisplays.pdf

materials to enable architects and engineers to design buildings and retrofits that maximize energy efficiency. The PIER program works closely with the Energy Commission's Building and Appliance Standards Office to ensure that new technologies can rapidly become part of either mandatory standards, or higher, voluntary "tiers". Continued strong state support for public interest energy research is needed to develop and bring to market tomorrow's technologies that will get California to its 2050 emissions reductions goals.

Benefits and Costs

California has and continues to pursue energy efficiency for a variety of energy and environmental reasons, including:

- Reducing energy supply costs and lowering bills for customers,
- Reducing peak energy demand,
- Maintaining reliable energy services and reducing price volatility, and
- Achieving other environmental objectives such as reducing local air pollution and other environmental impacts of electricity generation.

Investments in energy efficiency also provide numerous benefits on an economy-wide scale, by reducing the need for energy imports, cutting emissions and the associated health-related costs, and creating technical jobs, jobs in construction trades, and other high-paying professional jobs. Based on past experiences, each dollar spent on energy efficiency in California provides about two dollars in net benefits.[72]

End-use efficiency investments inherently result in reduced electricity generation and therefore provide both environmental justice and public health benefits. Utility energy efficiency programs are designed to provide a fair distribution of funds among residential and nonresidential customers, while maximizing energy savings. In addition, there are targeted programs overseen by the Low-Income Oversight Board that provide energy efficiency services specifically for low-income households. The CPUC's strategic plan targets broader, more comprehensive, and more effective energy efficiency services for low-income households.

The potential costs and emissions reductions from meeting the recommended targets and the expanded targets under evaluation are summarized in the table below. For purposes of this analysis, ARB assumed a 7.8 percent avoided line loss for electricity saved.

Appendix C: Electricity and Natural Gas
Table 12

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
E-1: Energy Efficiency (Electricity)	15.2	-1,663	CPUC & CEC	Ongoing
CR-1: Energy Efficiency (Natural Gas)	4.3	-470	CPUC & CEC	Ongoing

[72] California Environmental Protection Agency, 2006, *Climate Action Team Report to Governor Schwarzenegger and the Legislature*

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

(CR-2) Solar Water Heating

Solar water heating (SWH) systems represent what is likely the largest untapped potential for natural gas savings in California. California residences and commercial buildings consume at least 2.5 billion therms of natural gas annually to heat water. With statewide implementation of solar water heating, a significant portion of this could be saved.

A solar water heating system uses the sun to heat water. It commonly consists of two parts: a roof-mounted solar collector to heat the water and a storage tank. Most SWH systems augment rather than replace the conventional water heating system. A typical residential SWH system reduces the need for conventional water heating by about one-half to two-thirds, depending on the technology used.

Solar water heating is an enabling technology for zero net energy buildings,[73] and successful implementation of the zero net energy targets will require significant growth and improvements in California's SWH system manufacturing and installation industry. Looking out to the 2050 emission reduction goals, solar water heating will be even more essential because the technology can provide carbon-free water heating. At this time, California's SWH industry is still quite small and not well established, lacking the experience and economies of scale to deliver cost-effective solar water heating for most applications.[74] This needs to change if California is to meet its GHG reduction targets.

The widespread use of SWH technology in Israel, Japan, China, and Europe demonstrates that these systems can be cost effective, and can gain high levels of market share compared to traditional, carbon- intensive hot water technologies. If California can create sufficient sustained demand for these systems, it will allow the industry to mature, and to reap economies of scale that result in cost savings. New developments in SWH technologies, and improved business models for delivering these systems to customers, will further enable successful transformation of the SWH market.

[73] A "zero net energy" building must produce enough electricity to offset both the electrical and natural gas use of the building on an annual basis. Heating water with high-efficiency gas or electric technologies is a valid approach but solar water heating coupled *with* high-efficiency gas or electric heating is a better approach because it enables a downsizing of the onsite renewable generation system.

[74] As the price of carbon is reflected in the price of electricity and natural gas, SWH technologies will begin to be more cost-effective. Also, SWH technologies may be cost-effective already for certain commercial applications.

Solar Space Heating and Cooling

While less well-known, solar water heating can be used to provide the heat for forced air and/or radiant heating systems, and can even be used for cooling using absorption chillers. These technologies have been installed in limited numbers, but offer tremendous potential for cost-effective and carbon-free space heating and cooling. Space heating and water heating are each responsible for about 44% of California's residential CO_2 emissions. Combining water heating and space heating system components to create a single system to provide both capabilities is expected to become more widely available. The reduction in natural gas consumption and CO_2 emissions associated with residential space heating could potentially be equal to or greater than those being targeted for residential water heating.

The California Legislature took an initial step towards these goals with AB 1470, also known as the Solar Hot Water and Efficiency Act of 2007 (SHWEA). SHWEA authorized the CPUC to undertake a ten-year, $250-million incentive program for solar water heaters with a goal of promoting the installation of 200,000 solar water systems in California by 2017. The CPUC is currently running a pilot program to evaluate the potential impacts on equipment prices, demand, and overall cost-effectiveness of a SWH incentive program. If the pilot program proves to be cost effective, the CPUC will design and implement a statewide incentive program.

Regardless, the current legislative target of 200,000 units is relatively small and will unlikely create the economies of scale necessary for market transformation and significant cost reductions. Therefore, ARB recommends that California pursue other approaches with the goal of developing a viable SWH industry for 2020 and beyond. For example, California agencies could develop partnerships with U.S and foreign manufacturers, installers, and non-profits to:

- improve and expand upon current SHW technologies;
- develop commercialization strategies based on those that have effectively and rapidly launched other environmentally-preferred technologies;
- establish incentive programs, where appropriate; and
- incorporate these technologies into local government green building codes, and eventually into the CEC building standards.

Greenhouse Gas Reductions

For this analysis, ARB staff assumed gas savings of 130 therms per year per system, based on preliminary estimates from the California Center for Sustainable Energy pilot project in southern California. This estimate is based on a typical residential unit but would be extremely conservative for most commercial applications. Note that the AB 1470 program is already funded and is not linked to the AB 32 effort. Therefore, the cost of GHG reductions for the AB 1470 program is assumed to be zero.

Appendix C: Electricity and Natural Gas
Table 13

Reduction Measure	Potential 2020 Reductions $MMTCO_2e$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
CR-2 - SWH: AB 1470	0.1	0	CPUC	2010-2020

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

(E-4) Million Solar Roofs Program

As part of Governor Arnold Schwarzenegger's Million Solar Roofs Program, California has set a goal to install 3,000 megawatts of new, solar capacity by 2017 - moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The Million Solar Roofs Program is a ratepayer-financed incentive program aimed at transforming the market for rooftop solar systems by driving down costs over time. Created under Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), Million Solar Roofs builds on previous ratepayer-funded programs[75] and provides up to $3.3 billion in financial incentives that decline over time.

Solar-generated electricity produces no emissions and requires very little maintenance. Yet, for many applications, the technology is not yet cost competitive with electricity from conventional sources. Meeting California's solar targets, therefore, requires incentives, at least until new technologies and steady market demand bring about cost reductions.

The Million Solar Roofs Program has three distinct program components, each with a portion of the statewide budget and solar installation goals:

- The California Public Utility Commission's $2.17 billion portion of the program, known as the California Solar Initiative,[76] directs incentives to customers in investor-owned utility territories (about 70 percent of the state's total retail and wholesale electricity use) for existing residential and new and existing non-residential buildings. The goals for this program component are: 1,750 MW of installed capacity from the mainstream incentive program and 190 MW from the forthcoming low-income resident incentive program.
- The CEC provides incentives for solar in new home construction through its New Solar Homes Partnership (NSHP). The NSHP also is limited to investor-owned utility customers and is authorized to use up to $400 million over the program term with a goal of installing 400 MW of solar on new homes.
- The POUs component requires each municipal utility to offer an equivalent incentive program, an aggregate commitment of $784 million over the duration of the program, toward a goal of installing 660 MW of solar.

[75] Renewable energy incentive programs that preceded CSI include the CEC's Emerging Renewables Program and the California Public Utilities Commission's Self Generation Incentive Program. These programs no longer include solar, but still provide incentives for wind energy and fuel cells. A number of publicly owned utilities also have asolar programs.
[76] "California Solar Initiative" is also used to describe the entire program – including the portions managed by the CEC and the publicly owned utilities. To avoid possible confusion with the CPUC's program, however, ARB is using "Million Solar Roofs" when referencing the program in its entirety.

As directed by SB 1, the CEC recently established eligibility criteria, conditions for incentives, and rating standards for solar energy system incentive programs. Per the new guidelines, obtaining the incentives requires that building owners or developers meet certain efficiency requirements: specifically, that new construction projects meet energy efficiency levels that exceed the state's Title 24 Building Energy Efficiency Standards, and that existing building owners conduct an energy audit. By requiring greater energy efficiency for projects that seek solar incentives, the state is able to reduce both electricity and natural gas needs and their associated GHG emissions. Thus, the program can help to achieve ARB's recommended efficiency targets.

Progress towards the 2017 target is promising, though the net metering cap and the lack of compensation for "surplus" generation could pose a challenge. Under California's net metering law, participants are credited for any excess electricity generated during the day, and are allowed to draw down that credit at night or any time when the on-site electrical load exceeds what the system produces. Under existing law, the amount of customer "demand side" generation eligible for net metering is subject to a statewide cap and to a size whose production is no greater than the annual demand of each participating host customer. If customers produce more than they consume, the surplus is used by the electric utility without any compensation to the customer. To ensure good progress toward the program goals, the net metering cap must be increased[77] in order for additional solar systems to participate, and customers must be allowed to install systems that produce "surplus electricity" and receive fair compensation. .Compensation for surplus generation is critical both for meeting the program goals and for supporting zero energy buildings.[78]

Benefits and Costs

The installation of solar electric technologies and the requisite energy efficiency measures will result in savings to customers via lower energy bills. Further, the solar industry provides in-state jobs to solar manufacturers, retailers and installers.

To realize greater energy efficiency benefits, the CEC could require more advanced levels of energy efficiency as a condition for solar incentives. It should be noted that such a requirement is not widely supported by the solar industry due to fears that aggressive energy efficiency rules would hurt solar sales.

The estimated costs and potential GHG reductions from the solar elements of the Million Solar Roofs program and the expanded Measure under Evaluation are shown below. Both assume a 17 percent capacity factor for solar photovoltaics, and a 7.8 percent avoided line loss for each kWh

[77] Senate Bill 1 raised the net metering cap from .5 percent to 2.5 percent of peak demand. However, it is anticipated that this cap will support only half the state's solar goal and needs to be raised again before the state reaches the 3,000 MW solar capacity goal.

[78] Most buildings use electricity and natural gas. To be "zero net energy," buildings will have to balance gas use by producing surplus electricity, except for those few buildings, like all-electric buildings with heat pumps or dairy facilities, able to supply their own space and water heating needs. The 2007 IEPR recommended that the Energy Commission and the CPUC "work together to establish an appropriate feed-in tariff for excess generation from customer-owned solar installations based upon the RPS market price referent (MPR) and time-of-delivery adjustment." However because the MPR does not consider the grid benefits of distributed solar generation, a higher feed-in tariff should be considered. Such a tariff could speed progress toward GHG reduction goals and more rapidly achieve the market transformation goals of the Million Solar Roofs programs.

saved. (This estimate does not include the potential emissions reductions as a result of the new efficiency requirements associated with the program. Because program participants generally receive energy efficiency rebates from the utility company in addition the rebate for solar, the GHG reductions due to energy efficiency improvements are shown under the Energy Efficiency measure described elsewhere in this section.)

If tradable renewable energy credits (RECs) from the Million Solar Roofs Program are allowed in the RPS program, care must be taken not to double count the associated GHG emission reductions.[79] Also, as the scale of distributed generation PV in California grows, greater coordination of tracking mechanisms may be needed to avoid double counting GHG emission reductions from Million Solar Roof RECs sold in the voluntary REC market.[80]

Appendix C: Electricity and Natural Gas
Table 14

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
E-4 – Million Solar Roofs: 3,000 MW by 2017	2.1	0**	CPUC/CEC	Current program

* Excluding the cost of net metering credits
** Costs of this measure are the result of other programs and are not attributed to the AB 32 GHG reduction program
† The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

(E-2) Increasing Combined Heat and Power

ARB recommends that California take steps to encourage the development of new CHP facilities, with a target of an additional 4,000 MW of installed CHP capacity by 2020. This amount of CHP would be enough to displace approximately 30,000 GWh of demand from other power generation sources.[81]

CHP systems, also referred to as cogeneration, generate electricity and useful thermal energy in an integrated system. Combustion-based power plants do not convert all of their available energy into electricity and typically lose more than half as excess heat. By producing both heat

[79] CPUC Decision 07-01-018 in Rulemaking 06-03-004, January 11, 2007, Opinion Adopting Methods to Determine the Renewable Energy Credits from Renewable Distributed Generation, http://docs.cpuc.ca.gov/WORD_PDF/FINAL_Decision/63678.PDF. In CPUC Decision 08-08-028 in Rulemaking 06-02-012, the CPUC defines a REC to include "all renewable and environmental attributes associated with the production of electricity from the eligible renewable energy resource…" with the caveat that "[a]voided emissions may or may not have any value for GHG compliance purposes."
[80] For more information on the voluntary REC market, see http://www.green-e.org/getcert_re.shtml. For information on tracking in compliance and voluntary REC markets, see p. 8-12 of US DOE NREL, Lori Bird and Elizabeth Lokey, October 2007, Interaction of Compliance and Voluntary Renewable Energy Markets, NREL/TP-670-42096, http://apps3.eere.energy.gov/greenpower/pdfs/42096.pdf.
[81] Accounting for avoided transmission line losses of seven percent, this amount of CHP would actually displace 32,000 GWh from the grid.

and electricity, CHP systems use more of the energy contained in fuel, thereby increasing efficiencies and reducing GHG emissions. The widespread development of CHP systems would help displace the need to develop new or expand existing power plants. This should produce statewide and regional benefits.

CHP systems are generally used in distributed generation applications located at or near electrical and thermal loads. The electricity generated from a CHP system can be either consumed on site or delivered to the grid; the useful thermal energy can be exported to neighboring facilities but is typically consumed on site. By simultaneously reducing fuel requirements for on-site process heaters and electricity generation, CHP systems can be an extremely fuel-efficient and cost-effective form of distributed generation. Some CHP units can be fueled with renewable resources,[82] and those fueled by natural gas generally use less fuel to provide both heat and power than would be used to provide these two services separately.

CHP is used in many different applications. Small units less than 1 MW in size are often installed in places like nursing homes, schools, and laundries. Larger units ranging in size from 5 to 10 MW usually require host sites that have continuous thermal energy needs. Food processors, large data centers and transportation facilities are examples of applications for CHP projects in this size range. CHP projects in the 10 MW to 60 MW range are found in facilities that operate continuously and are sometimes connected at the transmission level, such as chemical plants or oil refineries. Very large units, which can range in excess of 100 MW, feed substantial amounts of power onto the grid for use by other customers as well as serving the thermal and electric needs of the host site.

While CHP systems use fuel more efficiently than centralized power plants, they have the effect of increasing fuel use on-site. The potential emissions from CHP systems varies significantly depending upon the system size and type of technology used,[83] but the increase in fuel use generally causes increased emissions of CO_2 on-site. Potential local adverse effects need to be prevented or mitigated through the existing air permitting process.

California has supported CHP for many years, but market barriers stand in the way of CHP reaching its full market potential. The key difficulty faced by CHP owners is the inability to sell excess electricity to the grid. Sizing CHP systems to operate efficiently often results in the generation of excess electricity. Without a market for this power, many CHP systems may not provide adequate economic return. While this is not the only challenge, it seems to be the most commonly-cited barrier to the development of new CHP systems.

A 2005 draft report prepared for the California Energy Commission by the Electric Power Research Institute (EPRI)[84] examined these barriers and their effects upon the market for CHP. EPRI developed estimates of current CHP capacity in the state, estimated technical and

[82] According to the 2007 IEPR, "Greater use of combined heat and power systems fueled by biomass could also reduce demand for natural gas in process and industrial heat and cooling operations, helping to increase overall energy efficiency and reduce carbon impacts of the state. By 2050, nearly 100 billion cubic feet of biomethane per year could contribute to the state natural gas supplies." CEC 2007 IEPR, p. 176.

[83] Molten carbonate fuel cells, for example, convert chemical energy directly into electricity while producing very little pollution. (Kaarsberg, 2001)

[84] California Energy Commission, Consultant Report, Assessment of California CHP Market and Policy Options for Increased Penetration. Prepared by Electric Power Research Institute. April 2005.

economic market potential, and analyzed the costs and benefits of various incentive options to promote development of the CHP market opportunity. Using different forecasts of technology costs, natural gas and electricity prices, and program design, EPRI predicted a potential market for CHP of between 1,966 MW and 7,300 MW over the period 2002-2020.[85] The 7,300 MW modeled under EPRI's "high deployment scenario" represents an increment of more than 5,000 MW above the base case. EPRI concluded that reaching this level of CHP deployment would require fully addressing the export barriers, utility-provided incentive payments, technological advances, the addition of a T&D (transmission and distribution) support payment, and a CO_2 reduction payment. Under their "moderate" scenario, which considered more modest changes in policy and incentives, EPRI predicted a CHP market potential as high as 4,400 MW. It is this estimate that forms the basis for the proposed GHG reduction measure.

Existing CHP Policy

The Waste Heat and Carbon Emissions Reduction Act[86] requires the CPUC and CEC to evaluate new rules and programs for small CHP systems (up to 20 MW in size). Specifically, the Act directs the CPUC to establish a feed-in tariff – a pre-negotiated price that utilities would pay for excess electricity fed into the grid. Under the Act, the CPUC may require California IOUs to purchase specified amounts of excess electricity from CHP customers that comply with specified sizing, energy efficiency, and air pollution control requirements. The statute also authorizes the state's POUs to purchase excess electricity from CHP systems at a rate determined by their governing boards. The Act requires the CPUC to establish a pay-as-you-save pilot program that would provide up-front financing to nonprofit organizations for the development of CHP systems of 20 MW or smaller. The CPUC may stop the pilot program after the cumulative capacity from the pilot program reaches 100 MW.

Although this Act will provide some support for CHP, it stops short of providing small CHP operators with the guaranteed access to wholesale markets recommended in the CEC's *Integrated Energy Policy Report*.[87]

Setting New Policies for CHP

ARB anticipates that GHG emissions from many CHP Systems will be regulated under the proposed GHG cap-and-trade program. However, efforts to increase the deployment of CHP systems will require removing market and regulatory barriers and providing adequate utility support to CHP system development. The CEC listed several recommendations in its 2007 IEPR to address the more critical barriers and provide adequate support for CHP system development, including the following:

- The CPUC's self-generation program incentives should be based upon overall efficiency and performance of systems, regardless of fuel type.

- The CPUC should complete a tariff structure to make CHP projects cost and revenue neutral while granting owners' credit for system benefits such as reduced congestion

[86] AB 1613 (Blakeslee, Chapter 713, Statutes of 2007)
[87] California Energy Commission, 2007, *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMF

- The CPUC and CEC should eliminate all non-bypassable charges for CHP systems regardless of size or interconnection voltage and standby reservation charges.

- The CPUC should refine the Rule 21 interconnection standards, provide third party resolution of interconnection issues and streamline permitting.

- The CPUC should develop a distributed generation (including CHP) portfolio standard regardless of size or interconnection voltage for electric utility procurement plans. Alternatively, the utilities could be required to treat distributed generation and combined heat and power, regardless of size or interconnection voltage, like efficiency programs.

- The CPUC should adopt revenue neutral programs that enable high-efficiency CHP systems to more easily export power to interconnected utilities without additional transmission system charges.[88]

- The CPUC and the Energy Commission should continue to work collaboratively to develop a methodology to estimate distributed generation costs and benefits.

- The state should adopt greenhouse gas measures and regulations that fully reflect the benefits of combined heat and power with separate production of thermal and electric energy[89]

Achieving the proposed 4,000MW goal by 2020 will require that immediate and aggressive steps are taken to address the above recommendations.

The CPUC intends to open a new rulemaking focusing exclusively on CHP this year. During this proceeding, the CPUC is expected to explore regulatory issues that directly affect the development of ultra-clean CHP, and to make decisions regarding how to facilitate the development of efficient and environmentally beneficial CHP. This will require discussions about how CHP generators can participate in a generation market that requires scheduling hour-by-hour exports with the CAISO.

The CPUC and CEC should use this venue to address the IEPR recommendations and remove the most significant CHP market barriers. Once these barriers are addressed, ARB will evaluate the need for additional mandates, efficiency standards or requirements that ensure GHG reduction goals are met. These additional steps may not be needed if market barriers, and utility support for CHP system owners, are appropriately addressed by the state's energy agencies.

Benefits and Costs

In addition to the energy cost savings and carbon emission reduction benefits, the development and use of well-designed additional CHP systems in California offer other environmental and power generation/distribution benefits. Reliable baseload or load-following CHP can:

- Provide an alternative to new central station fossil-fuel generation and reduces the need for new transmission and distribution infrastructure.

[88] Ibid.
[89] Ibid.

- Improves the efficiency, reliability and security of the State's electricity system and reduces losses during peak hours.
- Provide valuable protection against supply outages and brownouts, especially at oil refineries.
- Provide more efficient fuel use, reduced energy costs and the most efficient and cost-effective form of distributed power generation.
- Effectively reduce transmission and distribution congestion.
- By offsetting more expensive peak electricity, provide potential cost savings to the host site.

For purposes of estimating GHG reductions, ARB staff estimated the electric generation potential from CHP (or the amount of electricity offset from the grid, based on an assumed 85 percent capacity factor), the total amount of fuel consumed onsite, and the amount of waste heat generated for useful thermal purposes (which was then used to calculate the amount of fuel not consumed to produce that amount of thermal energy). Emission gains and reductions were calculated for each of these elements and the net emission reductions are shown in the table below. Capital costs were annualized assuming a 30-year system lifespan and operating costs were estimated based on fuel inputs.

Appendix C: Electricity and Natural Gas
Table 15

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
E-2: Increasing Combined Heat and Power Use by 30,000 GWh	6.7	-1,311	CPUC & CEC	2009-2020

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

(E-3) Renewables Portfolio Standard

The CEC estimates that about 12 percent of California's retail electric load is currently met with renewable resources, including wind, solar, geothermal, small hydroelectric, biomass, and biogas[90]. California's Renewables Portfolio Standard (RPS), which was originally established under Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002), requires IOUs, CCAs, and ESPs to increase the percentage of renewable resources in their retail portfolios. While the original legislation gave IOUs until 2017 to meet a 20 percent RPS, Senate Bill 107 (Simitian, Chapter 464, Statutes of 2006) moved up the deadline to 2010.

[90] California Enerrgy Commission, April 2008, 2007 Net System Power Report, Commission Report, CEC-200-2008-002-CMF, http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002-CMF.PDF, p. 4-5.

A more aggressive RPS goal of 33 percent by 2020 has been proposed by Governor Schwarzenegger but is not yet codified into statute. In 2005, The CEC and the CPUC committed in the Energy Action Plan II to "evaluate and develop implementation paths for achieving renewable resource goals beyond 2010, including 33 percent renewables by 2020, in light of cost-benefit and risk analysis, for all load serving entities."[91] Given the importance of renewables to the success of AB 32, an appropriate target for 2020 should be set that is realistic yet pushes California's renewable energy use forward as far as possible. Based on Governor Schwarzenegger's call for a statewide 33 percent RPS, and the strong call for a 33 percent goal made jointly by the CPUC and CEC in their proposed final opinion[92], ARB is including the targeted 33 percent renewable mix as a Recommended Action.

POUs are required to set their own RPS targets.[93]. The governing boards of the state's three largest POUs, the Los Angeles Department of Water and Power (LADWP), the Sacramento Municipal Utility District (SMUD), and the Imperial Irrigation District (IID), have adopted policies to achieve 20 percent renewables by 2010 or 2011. LADWP and IID have established targets of 35 and 30 percent, respectively, by 2020. In the *Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*,[94] the CPUC and CEC recommended that ARB *require* the POUs to meet a 20 percent RPS by no later than 2017.

Reaching a target of 33 percent will require that California quickly address challenges such as program complexity, lack of transparency, permitting difficulties, and transmission, distribution and, for intermittent renewables, integration issues. Program complexity and high cost of participating in the IOU's RPS solicitation processes comprise barriers that especially challenge the ability of small renewable projects (less than 20 MW of capacity) to contribute their full potential to State renewable energy goals. Multiple government agencies must continue to work together to overcome these project development barriers. The 2008 IEPR Update proceeding at the Energy Commission is addressing this topic; further analysis is planned for the 2009 IEPR, building upon completed and on-going studies by the Renewable Energy Transmission Initiative (RETI), the CA ISO, and the CPUC.

RETI is an extremely important multi-agency initiative to identify competitive renewable energy zones and streamline approval of transmission infrastructure to access those zones. RETI will identify the transmission projects needed to access renewable power resource areas, facilitate transmission corridor designation and streamline the siting and permitting process. The state

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[91] CPUC and CEC, 2005, *Energy Action Plan II*, p. 6

[92] Joint recommendations of the CEC and the CPUC in *Proposed Final Opinion on Greenhouse Gas Regulatory Strategies*, published September 12, 2008 and to be considered for adoption in October, 2008 by the CEC and the CPUC. The document is CEC publication # CEC-100-2008-007-D, available through links at: http://www.energy.ca.gov/ghg_emissions/index.html and is also known as CPUC Proposed Decision of September 12, 2008, CPUC Proceeding R06-04-009 posted at http://docs.cpuc.ca.gov/EFILE/PD/89317.htm. An Executive Summary, Frequently Asked Questions, and other supporting documents are available on both web pages.

[93] California Public Utilities Code Section 387, subparagraph (a) reads as follows: Each governing body of a local publicly owned electric utility, as defined in Section 9604, shall be responsible for implementing and enforcing a renewable portfolio standard that recognizes the intent of the Legislature to encourage renewable resources, while taking into consideration the effect of the standard on rates, reliability, and financial resources and the goal of environmental improvement.

[94] CPUC and CEC Joint Agency Decision, March, 2008, *Interim Decision on Basic Greenhouse Gas Regulatory Framework for Electricity and Natural Gas Sectors*, CEC-100-2008-002-CMF

strongly supports this effort to streamline transmission planning and help bring new renewable projects online. The State will likely need to follow up this effort with work to bring together the parties that can most rapidly build and begin operation of needed renewable resources and transmission additions and improvements. The energy agencies should examine methods and mechanisms used by other states, and by European countries to rapidly bring in both large scale and distributed renewable resources; some of these may be applicable to California's electricity system and markets.

In addition to transmission planning, the state must consider grid reliability and grid integration issues associated with intermittent renewable resources (such as solar and wind). Flexible fossil resources (such as plants that supply power at peak times), dispatchable demand response, and storage will be needed to provide system ramping and regulation for increasing penetrations of intermittent renewable resources. Many of the system modernization needs for renewable integration were analyzed by the CEC's PIER program known as the Intermittency Analysis Project. The resulting final report discussed a specific resource scenario that could achieve 33 percent renewables by 2020, provided needed transmission is built and sufficient grid modernization occurs, but noted that additional, more granular analysis was needed. The CPUC has since begun a staff and stakeholder process to refine a methodology that should help utilities plan long term procurement in a way that is consistent with the 33 percent goal, recently reaffirmed in the joint CEC-CPUC Proposed Opinion published on September 12, 2008. The IOUs and POUs must fully embrace this State goal and move quickly to make necessary system improvements. In procurement planning, it is critical both to maintain reliability while avoiding overinvestment of ratepayer funds in fossil fuel generation that could be come "stranded costs" to be paid by ratepayers in the future.

The California Independent System Operator (CAISO), the agency with primary responsibility for reliability and system planning in the IOU service areas, plans to begin a study later this year on the operating needs and costs of integrating 33 percent renewable energy.[95] Based on its November 2007 study of meeting 20 percent renewable energy, the CAISO has stated that costs could increase as more renewable energy is integrated into the grid. Continued CAISO support and analysis is needed to further understand changes needed to accommodate increasing renewables while maintaining reliability of the electricity and transmission system.

At least 17 European countries and the province of Ontario have adopted feed-in tariffs to speed the transition to renewable energy. The European experience suggests that use of well designed feed-in tariffs that are appropriate for California's energy system could lead to more rapid development of renewables. The CEC is examining feed-in tariffs as part of the 2008 Integrated Energy Policy Report proceeding[96]. In this process, small renewable generation developers (with under 20 MW of generation capacity) have noted the difficulty and high costs they face in the

[95] David Hawkins, July 21, 2008, "CAISO's Plan for Integration of Renewable Resources," California ISO presentation at the CEC 33 Percent Renewables Workshop, http://www.energy.ca.gov/2008_energypolicy/documents/2008-07-21_workshop/presentations/David_Hawkins_CAISO_Plan_for_Integration_of _Renewable_Resources.pdf.

[96] Documents, a June 30 public workshop transcript, and early results of this process are available at: http://www.energy.ca.gov/portfolio/documents/index.html#063008. Investigation of feed-in tariffs will continue to be documented in CEC's 2008 Integrated Energy Policy Report Docket 08-IEP-1/ also RPS Proceeding Docket No. 03-RPS-1078

IOU's RPS solicitation and contract negotiation processes.[97] Because feed in tariffs offer a known price and require limited or negotiation and legal costs for developers, they are one mechanism that can reduce the complexity, uncertainty, cost of financing, and costs of contract negotiation that currently make it difficult for some small renewable developers to participate in the RPS. Furthermore, small distributed renewable facilities often do not face the transmission barriers faced by large "utility-scale" projects, and, according to preliminary results in the Renewable Energy Transmission Initiative, such facilities can likely be brought into the electricity grid more rapidly than large scale projects.

The CEC's 2007 IEPR recommended a feed-in tariff for all RPS-eligible renewable facilities up to 20 megawatts in size. The CEC recommended that the feed-in tariff be set initially at the "market price referent" (MPR) determined each year by the CPUC. The MPR is a proxy price representing the cost of electricity from a modern, efficient combined cycle natural gas generation facility. In Europe, many feed-in tariff programs set technology-differentiated feed-in tariffs, based in part on the costs of different types of renewable generation. Such tariffs can encourage simultaneous development of technologies that are most cost-effective now, and of technologies that are on a path toward greater cost-effectiveness as they increase market share and their components (e.g., solar panels or wind turbines) are manufactured with increasing economies of scale. A tariff set initially at the MPR could immediately benefit small-scale facilities. And although the MPR is not technology-differentiated, it is calculated specifically for each project on a "time-of-delivery" basis, and thus it values peak power more than off peak power. As a result, a feed-in tariff at the MPR would be different for different technologies (e.g., solar and wind) based on generation output profiles, just as the prices paid to projects with different technologies vary in the current IOU RPS procurement process. To allow small renewable generation to reach its full potential share of the RPS, the energy agencies could implement feed-in tariffs or an alternate mechanism that facilitates additional distributed renewable generation up to 20 MW in capacity.

Benefits and Costs

Expanding the state's RPS goals to 33 percent by 2020will accelerate achievement of longer term (post 2020) GHG reduction goals, enhance fuel diversity, reduce reliance on fossil fuels, and reduce criteria pollutants. An expanded RPS will also further stimulate economic activity by providing opportunities for California companies that develop, produce, install, or operate renewable equipment. Studies have shown that the renewable energy sector generates more jobs than the fossil fuel-based energy sector per unit of energy delivered (i.e., per average megawatt).[98]

Further study is needed to determine which renewable technologies and fuel sources (e.g., solar, biomass, etc.) provide the greatest GHG benefits. This can help inform consideration of the

[97]See CEC draft Consultant Report, *Exploring Feed-In Tariffs for California: Feed-In Tariff Design and Implementation Issues and Options*, CEC publication # CEC-300-2008-003-D, June 20, 2008. A final report, incorporating additional public input, is expected toward the end of 2008. See also WebEx Recording of June 30, 2008 CEC workshop on feed-in tariffs, held as part of the 2008 Integrated Energy Policy Report proceeding. Both the report and the recording are online at: http://www.energy.ca.gov/portfolio/documents/index.html#063008

[98] Renewable and Appropriate Energy Laboratory, 2004, *Putting Renewables to Work: How Many Jobs can the Clean Energy Industry Generate*.

expanded use of feed-in tariffs, which could be designed to stimulate development of renewable resources with large GHG reductions.[99]

Appendix C: Electricity and Natural Gas
Table 16

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
E-3: Renewables Portfolio Standards (33% by 2020 for IOUs & POUs)	21.3	1,782	CEC/ CPUC	2020

*Note: The cost associated with this measure only reflect the incremental costs to achieve 33% RPS above the existing 20% RPS.

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

[99] For more information on issues and options related to expanding the use of feed-in tariffs for renewable energy in California, see the feed-in tariff documents in the CEC's RPS proceeding, available at http://www.energy.ca.gov/portfolio/documents/index.html.

6. WATER

This section includes the following measures:

<u>Recommended Actions</u>
(W-1) Water Use Efficiency
(W-2) Water Recycling
(W-3) Water System Energy Efficiency
(W-4) Reuse Urban Runoff
(W-5) Increase Renewable Energy Production
(W-6) Public Goods Charge for Water

ARB worked closely with the CAT to develop this Plan. Input from the CAT was compiled, evaluated and analyzed by ARB staff. Many of the measures included in the Recommended Actions are the direct input from the CAT for this sector.

Overview

For the purpose of this document, the Water sector is comprehensively defined and includes groundwater, surface water, agricultural use, urban use, conveyance, treatment, wastewater, and recycling. This sector plays a critical role in California and cuts across almost all other sectors. Approximately 19 percent of electricity and 30 percent of non-power plant natural gas consumed in California are used by the Water sector to grow crops, supply residential, commercial and industrial development, and produce energy. On top of these many, often competing needs, water is also necessary to maintain a healthy environment. Global warming will likely make it more challenging for California to meet all of these needs. The GHG reduction measures proposed for the Water sector are largely measures to develop additional supply reliability to meet the multiple, growing demands for water in California. Nevertheless, these measures can have many co-benefits including reducing GHG emissions.

Three of the measures (W-1, W-2, W-4) are water supply reliability measures. While efficiency and recycling have many benefits to the sector, the GHG emission reductions from these measures are accounted for in reduced energy requirements. Two of the measures (W-3, W-5) target reducing the amount of non-renewable energy used to convey and treat water and are also counted under the Electricity sector. These two energy efficiency measures apply to all the water projects, systems, and infrastructure in the State, large and small. California has a long and successful history of advancing efficiency and conservation in both the Water and Electricity sectors. Without these ongoing activities, business as usual GHG emissions associated with water use in 2020 would be higher than is currently forecast.

In addition, a mechanism to make allowances available in a cap-and-trade program could be used to provide incentives for local governments, water suppliers and third party providers to bundle water and energy efficiency improvements for small businesses or in targeted communities. This type of allowance set-aside will be evaluated during the rulemaking for the cap-and-trade program.

ARB also recommends a public goods charge for funding investments in the water sector to reduce GHG emissions. As noted by the Economic and Technology Advancement Advisory

Committee, a public goods charge on water can be collected on water bills and then used to fund end-use water efficiency improvements, system-wide efficiency projects and water recycling. DWR, as part of their overall responsibility for managing water resources and reducing GHG emissions, can consider all of these objectives in designing the Public Goods Charge program. Depending on how the fee schedule is developed in a subsequent rulemaking process, a public goods charge could generate $100 million to $500 million annually to invest in efficiency improvements and other projects that reduce GHG emissions. These actions would also have the co-benefit of improving water quality and water supply reliability.

Recommended Actions

W-1: Water Use Efficiency

Using water more efficiently is one of the key ways to provide water for a growing California. The Governor directed State agencies to develop and implement a plan to achieve a 20 percent reduction in per capita urban water use by 2020. This directive builds on the California Water Plan Update 2005, which identified water use efficiency as a "foundational action" for California water management. California will achieve approximately 1.8 million acre feet (MAF) of urban water use efficiency by 2020 to meet the Governor's call.

To implement this 20 percent by 2020 goal, DWR, CEC, PUC, SWRCB, and the Department of Public Health (DPH) are collaborating to develop and implement various strategies and measures to increase water use efficiency and thereby avoid the need for more energy intensive sources of new supply. This initiative will need to utilize the many Integrated Regional Water Management planning and implementation efforts currently underway throughout California. During 2008, the five-agency group will prepare a statewide water use efficiency measure for the Public Review Draft of the California Water Plan Update 2009 and identify additional opportunities to reduce GHG emissions from the entire water sector.

Measures for achieving the directed water conservation target include:

- Best Management Practices
- Appliance Efficiency Standards
- Landscape Water Standards
- Agricultural Water Use Efficiency
- Analytical Tools
- Regulatory Actions

Appendix C: Water
Table 17

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Water Use Efficiency	1.4	TBD	DWR, SWRCB, PUC, CEC	Ongoing

W-2: Water Recycling

GHG emission reductions can be achieved when one water supply source is used as an alternative to another, more energy intensive source. Water recycling can reduce energy use and thereby reduce GHG emissions by increasing local water supplies rather than importing water from other regions or reliance on other energy intensive treatment processes. This measure proposes a requirement for development and implementation of water recycling plans by wastewater management agencies working with water supply agencies. This requirement would apply where the recycling of treated effluent is not maximized at wastewater treatment plants located in areas of imported water supply and where water recycling could require less energy than current water sources. Implementation of water recycling plans would be prioritized for those plants that discharge to water bodies from which the wastewater cannot otherwise be easily recovered, such as the ocean and brackish water bodies.

Modern municipal wastewater treatment facilities are capable of producing high quality recycled water that is suitable for a wide range of beneficial uses. The DWR publication Water Recycling 2030: Recommendations of California's Recycled Water Task Force reports that approximately ten percent of municipal wastewater in California is being recycled, but as much as 23 percent of the municipal wastewater flow could be recycled. This measure targets the 23 percent recycling goal by 2030. Finding suitable markets and funding treatment and distribution system costs are challenges to increasing the use of recycled water. The recommended public goods charge could be used to address this market barrier and provide funding for treatment and distribution systems.

Substantial energy savings could be realized if recycled wastewater was used to replace potable water in appropriate applications such as irrigation. The amount of energy required to import or recycle water varies widely throughout the State. The CEC has reported that water supply and conveyance of water from northern to southern California consumes an estimated 3.2 MWh per acre foot (AF). In contrast, the estimated energy needed to recycle wastewater is approximately 0.7 MWh per AF, but this value will vary with the level of treatment required. As a result, the potential energy savings that could be realized through water recycling is estimated as 2.5 MWh per AF in southern California communities that import water.

Appendix C: Water
Table 18

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Water Recycling	0.3	TBD	SWRCB, DWR	Ongoing

W-3: Water System Energy Efficiency

To meet the needs of Californians, the State's water systems include natural and man-made facilities for the capture, storage, conveyance, treatment, distribution and re-use of water, requiring energy at nearly every step. Consistent with the recommendations of the California Water Plan Update 2005 and the 2005 Integrated Energy Policy Report, this measure seeks to

reduce the magnitude[100] and intensity[101] of energy use in California's water systems through further implementation of energy efficiency measures such as more efficient pumps and wastewater treatment.

Setting a target of a 20 percent reduction from 2006 levels would yield an estimated savings of 4,400 GWh per year. A reduction in electricity consumption would in turn reduce the greenhouse emission associated with this amount of electricity generation. An assessment of actual potential is needed to determine if such target is reasonable.

Two mechanisms are proposed to assess the potential of increasing system (e.g. pumping and treatment) efficiency in the water sector: 1) construct tools and protocols to evaluate, measure, and verify the energy impacts of water system efficiency activities and programs, and 2) conduct research and demonstration projects that explore ways to reduce energy demand and thus the GHG emissions of those water systems. To accurately assess the potential GHG emission reductions that are possible, various tools are needed to evaluate, measure, and verify the amount of energy that could be saved at various stages in the systems. Use of these tools will assist in program implementation and help with evaluation of program effectiveness. These tools can also help water agencies and regional boards determine the most effective measures to implement as part of their water management strategies under existing requirements. These tools will be beneficial to ensuring the cost-effectiveness of projects and governmental accountability. Research is also needed to deploy advanced technologies in water systems to lower energy intensity, examine opportunities to shift loads to energy sources with lower GHG emissions, refine understanding of the interaction of water and energy within the State, and identify new and innovative technologies and measures for mutually achieving energy and water efficiency savings.

Appendix C: Water
Table 19

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Water System Energy Efficiency	2	TBD	CEC, PUC, SWRCB, DWR	Ongoing

W-4: Reuse Urban Runoff

GHG emission reductions can be achieved when any water supply or treatment process is replaced with an alternative supply or process that requires less energy. Capture or infiltration of urban stormwater to increase groundwater and/or stored supplies has the potential to achieve energy and emission reductions by reducing the need to obtain water from more energy intensive sources or processes.

100 Total energy consumed by a particular segment of the water use cycle. Peak demand is usually measured in megawatts and annual consumption in kilowatt-hours or megawatt hours.

101 Total energy consumed per unit of water to perform a water management-related action, such as desalting, conveyance, etc… This demand is usually measured in kilowatt-hours per million gallons.

Development of impervious surfaces and the reliance on traditional storm drain systems have reduced stormwater infiltration in urban areas. Traditional storm drain systems are designed to capture and convey water away from developed areas as swiftly as possible, typically discharging to streams or water bodies. Nontraditional stormwater management strategies emphasize the use of vegetated channels and natural landscapes to intercept runoff, slowing the discharge rate, increasing infiltration, and ultimately reducing discharge volume. Low Impact Development (LID) is probably the most recognized nontraditional approach, but the basic components are shared by other land use and planning techniques. Examples of LID techniques include actions such as adding rain barrels and disconnecting downspouts from storm drains, to more elaborate installation of underground cisterns, constructing surface storage basins, adopting water-saving street designs, and establishing undeveloped areas to infiltrate stormwater.

This measure proposes that LID be required to maximize the infiltration and/or capture of stormwater to increase local water supplies. Where favorable soil and geologic conditions exist, stormwater would be infiltrated to increase groundwater supplies. In locations where potential infiltration is either limited or not recommended, capture and storage would be required to preserve stormwater for nonpotable applications. In addition to LID techniques, this measure promotes development of regional infiltration facilities and neighborhood facilities to augment local water supplies.

A methodology has not been validated by the SWRCB to quantify the volume of water that could be captured and reused, or the energy savings that could be realized. Nevertheless, a pilot methodology is being evaluated to estimate the volume of water that could be obtained through urban stormwater capture, infiltration and/or storage. Applying this preliminary methodology to the urbanized area of southern California yielded estimates of 270,000–333,000 acre-feet of stormwater per year that could be obtained from new and redevelopment residential and commercial projects. Further investigation is warranted to validate these estimates.

Appendix C: Water-Recommended Actions
Table 20

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Reuse Urban Runoff	0.2	TBD	SWRCB	TBD

W-5: Increase Renewable Energy Production from Water

The purpose of this measure is to identify and implement specific projects that take advantage of the State's water system-related opportunities to generate renewable electricity. Examples of renewable energy existing within water and wastewater systems include water moving through conduits, sunlight, wind, and gases emitted during treatment of wastewater at wastewater treatment plants. The CEC's PIER[102] program estimates statewide generation potential from currently undeveloped in-conduit hydroelectric and wastewater treatment renewable energy

[102] California Energy Commission, 2005, *California Small Hydropower and Ocean Wave Energy Resources*: CEC-500-2005-074.
California Energy Commission, 2006, *Statewide Small Hydropower Resource Assessment*: CEC-500-2006-065

resources at a total of 2,100 GWh per year. Further development of renewable generation from solar and wind resources at water system sites would add to this total. Renewable energy generation at water and wastewater facilities will reduce GHG emissions by reducing the need for the facilities to consume electricity derived from fossil fuels. In addition to GHG emission reductions, benefits of projects developed under this measure may also include better management of on-site electricity load at water system sites, mitigation of electricity price volatility, contribution to meeting renewable energy standards, and capture and use of gases from wastewater in an environmentally-preferred manner.

Implementation of this measure will involve several mechanisms. Local agencies are encouraged to develop their own cost-effective projects. The use of existing financial incentives is also encouraged. Another mechanism is to assess economic potential to better target future incentives and research technologies to lower costs and improve performance.

Appendix C: Water-Recommended Actions
Table 21

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Increase Renewable Energy Production	0.9	TBD	CEC, PUC	2020

W-6: Public Goods Charge for Water

A public goods charge applied to water will raise funds for reducing GHG emissions resulting from capturing, storing, conveying, treating, using, and disposing of water. These funds would provide a stable and sustained source of revenue. Use of this revenue would further develop water use efficiency, water recycling, pumping and treatment efficiency, reuse of urban runoff, and increase renewable energy production from California's water system. DWR, as part of their overall responsibility for managing water resources and reducing GHG emissions, can consider all of these objectives in designing the Public Goods Charge program. These actions would also have the co-benefit of improving water quality and water supply reliability. Depending on how the fee schedule is developed it could raise approximately $100 million to $500 million per year.

The public goods charge would be applied to each water connection, be collected by each retail water provider in the State, and include all uses of water. This charge could be implemented in several ways. For example, it could be a flat rate per connection i.e. not based on the quantity of water use and therefore not likely to directly reduce water use or the associated emissions. Or, the charge could be per unit or tiered with no charge or a low charge for use at or below some baseline with higher rates charged for higher levels of use. In either case, the funds could be invested in local, regional, and statewide efforts to increase efficiency and renewables, thereby achieving both GHG and criteria pollutant benefits.

Appendix C: Water-Recommended Actions
Table 22

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Public Goods Charge for Water	TBD	100 - 500	DWR, SWRCB, PUC, ARB	TBD

7. GREEN BUILDING STRATEGY

This section includes the following measures:

(GB-1) Green Buildings:
Greening New and Existing State Buildings
Greening Public Schools
Greening New Residential and Commercial Construction
Greening Existing Homes and Commercial Buildings

ARB worked closely with the CAT, its Green Building subgroup, and an advisory group to develop this measure. This section has significant overlap with the Energy Efficiency and Conservation measures (E-1 and CR-1) discussed within the Electricity and Natural Gas Sector. Green building design emphasizes synergy among all building systems , including those related to water, waste, electricity and natural gas, and other areas to achieve both GHG and other concomitant environmental benefits that may not be GHG related, such as improved indoor air quality, reduction of waste streams to landfills, and better pedestrian and transit friendly communities. This Plan includes a Green Building Strategy for its GHG benefits to the State.

Overview

The lifecycle impacts of the built environment have enormous implications for California's carbon footprint. The design, construction, demolition, renovation, maintenance and operation of buildings together account for considerable electricity and natural gas demand, water usage, and waste generation, each of which results in GHG emissions. Building electricity and natural gas use alone accounts for almost one quarter of all California emissions. The mining, harvesting, processing, and transportation of building materials used in construction and products used in the operation of buildings account for further GHG emissions. Finally, the choice of where buildings are sited and how they are integrated within communities also affects transportation patterns and infrastructure needs resulting in potentially significant GHG impacts.

"Green buildings" are designed, built, renovated, operated, and maintained using an integrated approach that creates and ensures a healthy and comfortable environment while maximizing energy and resource efficiency. Factors that are considered when designing a green building include: site selection and development, water and energy use, environmentally preferable products and materials, waste management, and indoor environmental quality. As such, green buildings are a vital tool for meeting the objectives of AB 32 because they provide a mechanism for reducing GHG emissions from multiple sectors – principally energy, water, waste, and transportation; while minimizing other undesirable environmental and community impacts.

Employing a *whole-building or integrated systems* design approach can create synergies that result in multiple benefits at little or no cost, allowing for efficiencies that would never be possible on an incremental basis. Reducing air leakage and employing good passive solar design, for example, can dramatically reduce the building's heating and air conditioning requirements. The cost savings can then offset costs of other green building features, such as sustainable materials, photovoltaics, more-efficient appliances, or gray-water recovery systems for landscape irrigation. This synergistic design leads directly to reduced energy use and an overall lower GHG footprint for the building.

While green building strategies are most easily integrated into new buildings, existing buildings offer the greatest potential for gains in efficiency. California has made impressive strides in improving energy standards for new construction but many buildings were built before energy standards were required for new construction. Even buildings less than ten years old offer a significant opportunity for improved performance with the implementation of technically-feasible and cost-effective technologies and practices. Reducing GHG emissions related to existing buildings is also recognized and discussed as a critical strategy in the Electricity and Natural Gas section.

GHG Reduction Strategies

California can reduce the carbon footprint of the built environment by adopting comprehensive policies that address energy and water consumption, land use, waste management, and other critical components of designing, constructing, maintaining, operating, and renovating both new and existing buildings. Capturing the full GHG reduction potential from buildings will require a statewide effort, consisting of both mandatory and voluntary actions that are supported by incentives and education.

Current Green Building Policies and Programs

There are several prominent existing state policies that mandate and/or encourage green construction. These include, but are not limited to:

1. Green Building Initiative

The Executive Order (EO) S-20-04, known as the Green Building Initiative, requires that the State commit to aggressive action to reduce State building electricity purchases from the grid by retrofitting, building and operating the most energy and resource efficient buildings, and by taking all cost-effective measures described in the Green Building Action Plan[103] for facilities owned, funded or leased by the State. The EO also encourages cities, counties and schools to do the same. Specifically, it requires state agencies, departments, and other entities under the direct executive authority of the Governor to cooperate in taking measures to reduce grid-based energy purchases for state-owned buildings by 20 percent by 2015, through cost-effective efficiency measures and distributed generation technologies. These measures include:

- Designing, constructing and operating all new and renovated state-owned facilities paid for with state funds such that they can be certified at the "Silver" level or better, under the Leadership in Energy and Environmental Design (LEED) program known as *LEED for New Construction* (LEED-NC)[104];
- Identifying the most appropriate financing and project delivery mechanisms to achieve these goals;
- Seeking out office space leases in buildings with a U.S. EPA Energy Star rating; and
- Purchasing or operating Energy Star electrical equipment whenever cost-effective.

[103] State Green Action Team, *Green Building Action Plan*, available online at: http://www.documents.dgs.ca.gov/green/GreenBuildingActionPlan.pdf

[104] LEED has four levels that can be earned for increasing levels building "greenness." They are: certified, silver, gold and platinum. These levels are available based on points earned through meeting the various green requirements. There are separate systems of these four levels with different requirements for new and existing buildings.

The EO also references the Green Building Action Plan, which commits the State to benchmarking, retro-commissioning, and certifying existing Executive Branch facilities over 50,000 square feet in size so that they meet minimum certification requirements for *LEED for Existing Buildings* (LEED-EB) by 2015. The EO further requires the Division of the State Architect to adopt guidelines to enable and encourage schools built with state funds to be resource and energy efficient. The ARB encourages all state agencies to exceed minimum LEED-EB certification requirements, and to meet the silver, gold or platinum levels of LEED-EB.

2. California Green Building Standards Code

In July 2008, the California Building Standards Commission (CBSC) adopted the Green Building Standards Code (GBSC) for all new construction statewide. This initial code will provide a framework and meaningful first step in ongoing development of a statewide green building standards code. It is scheduled to become effective in July of 2009, at which time local jurisdictions may adopt the standards as mandatory if they choose. The code will establish mandatory minimum standards for residential buildings in the 2010 edition of the California Building Standards Code, anticipated to become effective around January 1, 2011. While the current version of the code also includes voluntary standards for commercial buildings and hospitals, GBSC anticipates adopting a mandatory code in 2011. In the future, these standards will be modified, enhanced, and expanded to cover other non-residential occupancies such as schools. The GBSC references energy efficiency building standards contained in the Title 24 Energy Code and sets targets for energy efficiency, water consumption, material conservation and solid waste management, and indoor air quality. ARB plans to work closely with CBSC, the California Housing and Community Development (HCD), the California Energy Commission, and the Division of the State Architect to ensure that the next version of the GBSC includes required provisions for energy, water, and waste reduction practices consistent with the measures identified in, and relied upon for, the Scoping Plan.

It is important that both voluntary and mandatory codes for green building be periodically revised, as are the State's Title 20 and Title 24 energy efficiency codes. Voluntary codes, written in code language, can serve as stretch goals for architects and building systems designers. They can also be adopted easily by local jurisdictions that desire requirements that exceed State minimums.

3. "Zero Net Energy" Buildings

The California Public Utilities Commission and the California Energy Commission have established "zero net energy" (ZNE) goals for new construction in California. By 2020, the goal is that all new homes will be ZNE. For commercial buildings, the target date for this goal is 2030.[105] These ZNE goals are discussed in more detail in the Electricity and Natural Gas section of the Scoping Plan.

[105] The *California Long Term Energy Efficiency Plan* covers a robust set of goals and recommended strategic plans for all sectors, including buildings. The plan addresses not only technical standards and technology development, but also recommends supporting implementation strategies needed via marketing, public education, workforce development, and integrated demand side solutions. This 100-page document can be found at: http://www.californiaenergyefficiency.com/index.shtml.

4. Funding Programs

The State offers funding programs to facilitate green building practices, such as:

- The Department of General Services (DGS) provides, under Proposition 1-D (2006), additional bond funding for new school construction or major renovation that meets high performance school standards modeled after the CHPS Criteria. However, the Office of Public School Construction (OPSC) recommends that the state support multiple paths to sustainability through CHPS or LEED. The DGS incentive for green school construction provides up to an additional 10 percent of state funding; however, the program is currently limited to a total of $100 million. The program is administered through the State Allocation Board and DGS's Office of Public School Construction.[106]
- The Department of Community Services and Development administers the federal Low Income Weatherization Program, which provides energy efficient retrofits for low-income households in California.[107] Such programs also address indoor pollution problems such as carbon monoxide and lead based paint, and has been shown to be very cost effective in terms of energy efficiency and other environmental and health benefits.[108] In addition, the CPUC regulates ratepayer funding of residential weatherization programs for all housing sectors administered though the investor-owned utilities (IOUs), but the utility programs use different protocols than the State program.
- The CPUC also oversees use of ratepayer funds for residential energy efficiency programs administered by IOUs and targeted at all qualifying low-income households in IOU service areas. Low-income households are estimated to be 30 percent of all households – or about 5.7 million homes throughout the State. These IOU-implemented programs collectively are known as the Low Income Energy Efficiency (LIEE) program. The LIEE spends about $250 million per year, and installs a wide range of efficiency measures, ranging from space and water heaters, and building shell weatherization to efficient refrigerators, air conditioners, lighting, low flow showerheads, and other appliances and measures. The measures are installed by private, non-profit, and local government entities under contracts with the IOUs. The CPUC has adopted a goal to install these measures in all qualifying and willing low-income households by 2020.

5. Third-Party Green Building Rating Systems

There are many green building rating systems available to evaluate and compare the energy efficiency and environmental performance of buildings. Most of these systems are voluntary programs that have strong presence within the building design communities. The following are three of the more well-recognized rating systems:

- Leadership in Energy and Environmental Design (LEED) – a nationally accepted green rating system that addresses new construction, existing commercial, residential, and retail buildings as well as schools and neighborhoods.

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[106] http://www.green-technology.org/green_technology_magazine/rob_cook.htm.
[107] http://www.csd.ca.gov/Programs/Weatherization%20Assistance%20Program.aspx.
[108] Oakridge National Laboratory, Various reports at http://www.eere.energy.gov/weatherization/ne_benefits.cfm. For example, see the non-energy benefits study by Schweizer and Tonn (2002) and the national evaluation report by Ternes et al. (2007).

- The Collaborative for High Performance Schools (CHPS) – a rating system that offers green building certification geared towards California schools.
- GreenPoint Rated – a rating system that provides green building certification for California homes.

While these rating systems are not equivalent to building codes, they do provide a useful way to encourage the design, construction, and operation of green buildings. As California proceeds in the development of a mature Green Building Standards Code, it will need to address the relevance of the code to these systems. Many of the voluntary stretch goals may continue to be based on the criteria within these green building rating systems, which have been adopted by many local governments. However, strong mandatory and voluntary green building standards in code language should be implemented by the state, and periodically revised, in order to set a minimum "floor" for green buildings and to encourage buildings that beat mandatory standards.

Recommended Actions

There are additional opportunities for reducing the carbon footprint of California's built environment. Capturing further GHG reductions from California buildings will require strategies that go beyond the requirements of the GBSC and the requirements of the EO, as described in green building measure GB-1.

Many of the green building strategies listed in GB-1 are similar to those listed in the Energy Efficiency and Conservation measure (E-1 and CR-1) of the Electricity and Natural Gas section because energy efficiency and renewable energy are key components of green buildings and have a significant ability to reduce California's greenhouse gas emissions.

GB-1: Green Buildings

All of the following measures reference the Green Building Standards Code. The next iteration of the Green Building Standards Code, which the CBSC has stated will be in effect by 2011, must set stronger minimum mandatory performance standards and voluntary stretch goals for all buildings that go *beyond* current code. The requirements contained within the new GBSC will need to be aligned with and supportive of existing green building standards to achieve any meaningful improvement beyond those already offered by the energy standards. California will place a high priority on ensuring that the new GBSC fully incorporates more aggressive energy, water, and waste reduction requirements.

Greening New and Existing State Buildings

All state buildings should be required to exceed the current performance requirements outlined in the Governor's Green Building Executive Order S-20-04.

The Green Building CAT subgroup recommends the following green building policies:

1. All new and renovated state buildings larger than 10,000 square feet in size would need to meet the GBSC and be required to meet the following targets:
    - Beginning in 2010, all new buildings would be designed, constructed, and operated to achieve the performance level of LEED-NC 2009 "Gold" or better.

- Beginning in 2025, all new buildings would be ZNE (five years earlier than the statewide mandate for commercial buildings.) Until the ZNE target is reached, state buildings would exceed each new iteration of Title 24 energy code by 30 percent. (Note: reaching ZNE implies a 70-80 percent reduction in energy use compared to the Title 24 2008 Standard (with the balance of energy use addressed via renewable energy solutions.)

2. All single occupancy leases undertaken by the State would be LEED-NC 2009 "Silver" buildings unless compelling market conditions make this impossible. Multiple tenant leases would be in LEED-NC "Certified" buildings where possible
3. All existing state buildings over 25,000 square feet in size would achieve LEED-EB 2009 "Silver" certification by 2020. Smaller buildings would be required to be operated and maintained at a level equivalent to LEED-EB 2009 but certification would not be required.

The State owns and operates over 290 million ft^2 of occupied space representing a total of 13,429 existing buildings, with another 17.5 million ft^2 of newly constructed state buildings planned for completion by 2020. The green building objectives outlined in EO S-20-04 are mandatory for Executive Branch agencies. Agencies not under direct executive authority of the Governor, including universities, Administrative Office of the Courts, and Legislative branch facilities are encouraged to implement these strategies as well.

In order to meet the proposed requirements for existing buildings, a better funding mechanism is needed for identifying, evaluating, and implementing potential energy and water efficiency improvement projects. This process, which can entail retro-commissioning studies, Investment-Grade Audits, and program administration costs, requires up-front funds that can be difficult to obtain given current State operating procedures. Unless appropriations are provided for these activities, the State will need to find ways to fund them out of existing appropriations. One option would be to pool pro-rated contributions from all State agencies to provide continuing funding. Some portion of building operating cost savings could be paid into this fund to reimburse the front-end funds used to identify and undertake green building projects.

Greening Public Schools

New School Construction

All new schools would need to meet the GBSC and should be required to be built to CHPS California Criteria 2009 Edition or LEED for Schools and to successive standards as they are updated. By 2020, all new schools should also be required to be "Grid Neutral."[109] Such schools would be highly energy efficient, and would typically produce electricity for remaining needs through renewable generation or efficient combined heat and power systems.

CDE estimates that some 5,843 new classrooms per year are needed to accommodate the rising student population. The Governor's Executive Order S-20-04 encourages school districts to build all schools that receive state funds to be resource and energy efficient, but does not specify a standard. In response, the Division of the State Architect formed a Schools Workgroup that selected the CHPS "Best Practices Manual as the guidelines that would best meet the EO

[109] As discussed in the Collaborative for High Performance Schools, Best Practices Manual, Volume III, Criteria , http://www.chps.net/review/2009Edition/PR_UnMarked_CHPS09Criteria_VIII.pdf

requirements.[110]"

CHPS offers a green building certification program especially designed for K-12 schools in California. A CHPS school is a school that achieves excellence in environmental efficiency and healthy building practices. In addition to greenhouse gas benefits, CHPS schools provide a healthy learning environment for California's children and have been shown to improve learning performance. Schools can self-certify through the free CHPS Designed Program, or seek third-party verification of their high performance school through the CHPS Verified program.

Meanwhile, the Division of State Architect in cooperation with the Office of Public School Construction is creating a "Grid Neutral by Design" schools program to encourage schools built with state funds to produce as much electricity as they use over the course of a year. Achieving this goal would require new innovative funding mechanisms to supplement existing school funding programs.

This green building measure would transform school architecture such that CHPS and grid neutral design become standard practice, thereby ensuring that schools set an example and provide the best possible learning environments for California's children.

Existing Schools

All schools seeking State modernization funds should be required to meet CHPS California Criteria 2009 Edition or successive standards. Schools not going through a major renovation should be required, by 2020, to undergo energy and water testing and benchmarking, and to implement all efficiency measures with up to a ten year payback.

The State has more than 1,000 school districts educating more than six million students. The energy purchased to operate these schools costs California school districts over $1 billion annually and generates more than two million tons of CO_2 emissions each year.[111]

Updating existing schools can be accomplished through two mechanisms: major modernizations and minor retrofits. Major modernizations can be funded through the statewide school bond funding program administered by the Office of Public School Construction, which can fund major renovations on portable classrooms that are at least 20 years old and permanent buildings that are at least 25 years old, subject to the availability of bond funds. For school buildings not captured by this mechanism, alternative funding mechanisms will need to be established.

- ARB recommends that funding for school modernization be tied to meeting or exceeding CHPS 2009 standards for existing schools.[112] By changing these funding requirements, all public schools in California would eventually meet CHPS standards. ARB further recommends that by 2020 all schools undergo an environmental performance audit and benchmarking process to identify the best avenues for efficiency improvements. Existing schools should be required to undergo retrofits to improve energy and water efficiency by

[110] Schools Workgroup Implementation Plan http://www.documents.dgs.ca.gov/dsa/dsaab/implementation_memo2.pdf
[111] Based on information from a study completed in September 2004 for the California Green Building Action Plan
[112] It is anticipated that CHPS will be developing green building standards for existing schools by 2009

25 percent where feasible if they do not meet the minimum environmental performance criteria.

Greening New Residential and Commercial Construction

All new construction will need to comply with the California Green Building Standards Code. California should work with local jurisdictions to set and meet targets for new homes and commercial buildings to exceed the Green Building Standards Code.

California is expected to experience significant population growth in the coming decades, much of which is expected to take place in the state's hot inland areas. Estimates are that more than two million homes and almost 1.3 billion square feet of commercial space will be constructed between 2010 and 2020. Meeting California's aggressive climate change goals will require that these new buildings be very energy, water, and resource efficient.

Transforming the building industry will require a combination of mandatory and voluntary measures. Adoption of a mandatory GBSC for commercial construction is essential for improving the overall environmental performance of new commercial buildings. As described in the Energy Efficiency measure, it is also important to establish voluntary targets for builders to exceed the future mandatory GBSC. The California Long Term Energy Efficiency Strategic Plan suggests targets for a certain percentage of local governments to adopt "reach" standards for homes and commercial buildings to go beyond the minimum code, as well as for the market and utility incentive programs to work together to deliver target proportions of new homes and commercial buildings designed above code.

In support of their ZNE targets, the CPUC established an interim goal that 50 percent of new homes achieve energy savings that meet the Tier II standards of the Energy Commission's New Solar Homes Program by 2011. The New Solar Homes Partnership Tier II Energy Efficiency Requirements are:

- 35 percent Total Energy Savings Compared to 2005 Title 24
- 40 percent Cooling Energy Savings Compared to 2005 Title 24
- Energy Star for Builder Provided Appliances
- Full Compliance with Title 24 Lighting Requirements

In order to achieve statewide GHG emission reductions, these targets should be expanded to address other aspects of environmental performance. For example, these targets could be re-framed as a carbon footprint reduction goal for a 35 percent reduction in both energy and water consumption. For commercial buildings, a 2011 target should be established such that 25 percent of all new buildings reduce energy and water consumption by at least 25 percent beyond code.

Local governments are key players because they have explicit authority to pass ordinances and green building standards that are more stringent than the GBSC. Many local jurisdictions have begun to lead the way in green building. This Plan encourages local governments to adopt "beyond-code" green building requirements for all buildings, or offer incentives for builders to exceed state minimum codes. To assist this effort, State government must develop and regularly tighten voluntary standards, written in code language for easy adoption by local jurisdictions. As codes and standards push new construction toward a standard of ZNE, efforts for going "beyond

code" will need to focus on non-energy areas of improvement, such as water, embodied energy of building materials, solid waste, and transportation. The state could work with local jurisdictions to set the specifics of these targets, including options for certification,[113] incentives, reporting, and verification. The State can also assist local governments as they adopt ordinances that make mandatory the State's voluntary provisions of the GBSC.

As zero energy mandates are incorporated into the energy standards, some of these targets may need to be adjusted accordingly to account for a dwindling potential for improvements "beyond code." As we approach the 2020 and 2030 targets for zero energy buildings, these "percent above code" targets must shift to "percent of ZNE" targets. Zero energy new and existing buildings can be an overarching and unifying concept for energy efficiency in buildings, as discussed above (building energy efficiency measures E-1 and CR-1).

Greening Existing Homes and Commercial Buildings

Existing buildings account for the greatest potential for GHG reductions in the building sector. About two-thirds of California's homes and apartments – more than 8 million homes, were built prior to the 1982 energy efficiency standards. Similarly, about 5.25 billion square feet of commercial buildings were built before 1978 when the first commercial building energy efficiency standards took effect. Many of these structures have not undergone major remodels, and may be lacking in very basic energy efficiency features.

California should implement a combination of voluntary and mandatory programs designed to achieve major energy and water efficiency changes in existing buildings. This measure is also listed as a key tool for successfully implementing the Energy Efficiency measure (E-1 and CR-1**).**

California should establish a comprehensive environmental performance rating system for residential and commercial buildings. The purpose of such a system is to inform owners and prospective buyers relatively how well a building "performs" in terms of energy and water efficiency, as well as its overall carbon footprint. Understanding how a building's performance compares to its peers (i.e. "benchmarking") is an important first step to identifying appropriate efficiency improvements.

Specifically, this green building measure would encourage utilities (potentially working with third party providers) to offer environmental performance audits to all homeowners in their service territories, and to provide financing mechanisms for cost-effective energy and water efficiency improvements up to a specified limit (within regulatory guidelines for cost-effective use of ratepayer funds). The CEC and CPUC would be the likely entities to develop the details of this program, including setting aggressive targets for these utility-sponsored retrofits. The State's Low Income Weatherization Program with its established network of service providers and training programs should also be considered in implementing this green building measure. To achieve significant changes to the existing building stock, it may be necessary to establish a mandatory component to this program, for homes of a certain rating.

Similarly, utilities and other third parties are encouraged to offer a similar program for commercial building owners, promoting environmental performance testing and financial

[113] For example, the CEC's Tier II standards, LEED, and/or GreenPoint Rated homes.

incentives for retro-commissioning. The retro-commissioning process includes conducting a diagnostic evaluation of the entire building to identify operational problems, making appropriate repairs, and optimizing controls and sequences to improve overall energy performance and indoor air quality. New legislation[114] already requires energy use benchmarking and disclosure by all commercial building owners to prospective buyers, lessees, or lenders starting January 1, 2010. The next step would be to encourage commercial building owners to implement cost-effective measures and building improvements identified by the environmental performance audits at specified trigger events such as changes in ownership or remodeling[115].

Success with this measure will require lenders, appraisers, and other parties in the real estate industry attribute value to green buildings. Lenders should be encouraged to offer "energy and water efficient mortgages" that allow the buyer to qualify for a larger loan if the home is energy and water efficient. Lenders and appraisers alike must also be encouraged to factor the energy and water saving features of a home into their estimates of the home value and monthly utility bill outlay. In an energy efficient home, the utility bills would be much lower, and these bill reductions can more-than-offset the increase in mortgage payments. This, coupled with environmental performance rating systems such as HERS 2009, GreenPoint Rated for Existing Homes, and Energy IQ, will help consumers to include green building features into their decision making process.

Implementation Strategies

State and Local Governments Programs

Implementing these strategies will require leadership and strong policies from state and local government. State government plays a role in setting statewide targets, leading by example, and ensuring that model voluntary codes that surpass minimum state requirements are available for adoption as requirements by local governments within their jurisdictions. Local jurisdictions have distinct authority to pass ordinances and green building standards that are more stringent than the GBSC and energy requirements that exceed those of Title 24. If these local standards are based on state models already written in code language, builders will not face a mix of different requirements. Some local governments are already setting green building targets very similar to those recommended in this Scoping Plan, demonstrating their desire to be ahead of the curve in responding to the dual challenges of increasing energy prices and climate change.

Funding Mechanisms

Of particular importance is the need to provide workable funding mechanisms for the upgrade of existing buildings. Many existing buildings were built before more stringent energy codes were adopted and therefore offer proportionally more potential for improvement than newer buildings. With the US national average growth rate (in number of buildings) at approximately 1 to 2 percent per year, major GHG emission reduction efforts must necessarily be focused on existing buildings.[116] Funding mechanisms need to be established that will provide investment capital to upgrade these buildings in ways that account for and monetize extended lifecycle benefits, and that are not hampered by building sale or occupancy turn over. Taken individually, building

[114] AB 1103 (2007)
[115] Existing Title 24 building energy efficiency code applies to existing buildings that are renovated or remodeled in most cases. Implementation of the 2008 code for non-residential buildings is expected to result in a significantly higher portion of energy savings from existing, rather than new, buildings.
[116] American Physical Society, *Energy = Future, Think Efficiency*, Sept 2008, Page 53.

energy efficiency improvements are relatively small and incremental over time, and therefore easy to overlook. But increasing energy efficiency is very cost effective and the cumulative effect of widespread improvements in energy efficiency can amount to very substantial reductions in GHG emissions. However unless mechanisms are developed to encourage and fund such improvements the expected reductions are not likely to occur.

Mechanisms such as on-bill financing or energy efficiency services contracts can enable a building owner to implement improvements without having to provide up front capital. Such mechanisms allow the owner to finance energy or water efficiency projects with loan payments that are offset by utility bill savings over time. Other financial incentives such as grants, tax-exempt financing, direct loans, tax credits, and rebates could be improved to better encourage greater numbers of builders, contractors, owners, buyers and sellers of real property to invest in green buildings. Financing mechanisms are also needed for schools and state buildings. Non-financial incentives for green buildings are also crucial, and could include expedited permitting, priority plan review, green building technical assistance and recognition programs. Architects, builders, and homeowners often lack the time and resources to research green building design options, and applying for incentives can often be burdensome. Creating a "one stop shop" for information, resources, and incentives could make the process easier and faster for architects, builders, and homeowners. Improving access to technical information and implementing recognition programs could encourage market transformation through raising awareness and knowledge of green building practices and benefits.

One promising funding mechanism is local government sponsored loans for energy efficiency and renewable energy that can be paid back by being added to tax assessments. The City of Berkeley pioneered this concept, and has a program now under development. This mechanism means that the costs of improvements, or, for example, solar photovoltaics, can be amortized over a longer period than an ordinary home equity or commercial renovation loan. Furthermore, the low, amortized cost stays with the building, even if the building changes ownership. Berkeley, a charter city, was able to pass an ordinance to establish this mechanism. Legislation recently signed by the Governor now allows any California city to establish this kind of financing program for energy efficiency and building scale renewables[117].

GHG Reductions

Accounting only for potential GHG savings that arise from reductions in energy and water use and from the recycling of C&D waste, preliminary estimates are that green building measures can reduce California GHG emissions by approximately 26 $MMTCO_2E$ in the year 2020.[118] In this plan, most of these emission reductions are accounted for in the electricity, waste, and water sectors. Further research is needed to estimate transportation-related additional GHG emission reductions from green buildings. A complete evaluation of the interaction between the green building measures and other sector measures may reveal GHG reductions from green buildings that are, in fact, "additional" to those accounted for in the electricity and natural gas, recycling and waste, water, and other sectors. Case studies, protocols, carbon calculators, and decision-

[117] AB 811 (Levine), Chapter 159, Statute of 2008

[118] Initial estimates for GHG emission reduction potential for this sector are based on LEED "Certified" buildings, however many of the strategies recommend certification to "LEED Silver" or higher standards. Also, these estimates do not include savings from transportation or green operating procedures such as recycling. As a result, actual emission reductions could be greater than those estimated here.

support tools should be developed to measure and verify GHG emission reductions from green buildings.

Appendix C: Green Buildings
Table 23

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Green Buildings • Greening New and Existing State Buildings • Greening Public Schools • Greening New Residential and Commercial Construction • Greening Existing Homes and Commercial Buildings	26	TBD	Various	Various

8. INDUSTRY

This section includes the following measures:

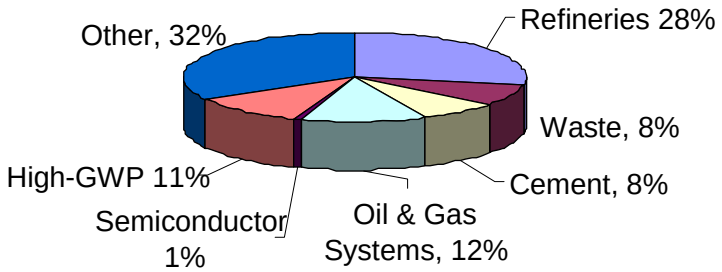
California Cap-and-Trade Program Linked to the Western Climate Initiative
(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources
(I-2) Oil and Gas Extraction GHG Emission Reduction
(I-3) GHG Leak Reduction from Oil and Gas Transmission
(I-4) Refinery Flare Recovery System Improvement
(I-5) Removal of Methane Exemption from Existing Refinery Regulations

Overview

The Industry sector in California covers a broad and diverse range of sources. The State, if it were a nation, would have one of the largest economies in the world; maintaining the economic health of California's business and industry while continuing to reduce criteria, toxic, and GHG emissions is vitally important. With over 100 $MMTCO_2E$ in emissions in 2004, the sources in these sectors account for approximately 20 percent of California's GHG emissions. Most emission reductions from the industrial sector will be realized through the Cap and Trade Program which will include large industrial sources. ARB is also proposing to develop two refinery measures and two oil and gas production measures as part of the Scoping Plan. Through the use of innovative technology and ideas to meet the requirements placed on the industrial sector, California can be an industry leader in creating new products and techniques to reduce emissions of GHGs.

Industrial and Commercial

Appendix C Figure 6



Recommended Actions

Cap-and-Trade Program

California is working closely with other states and provinces in the Western Climate Initiative (WCI) to design a regional cap-and-trade program that can deliver GHG reductions throughout the region. ARB will develop a cap-and-trade program for California that will link with the programs in the other WCI Partner states and provinces to create this regional market.

The WCI proposes to include emissions from industrial facilities in the cap-and trade program. Both fuel consumption and process emissions are recommended for inclusion. Large emitters would have a direct regulatory obligation under the program based on their facility emissions. Those covered by the program would have flexibility in how best to meet their regulatory obligation to surrender emission allowances to cover their actual emissions in each compliance period. Consistent with the WCI draft recommendations, California's preliminary recommendation is to include all large industrial facilities within the cap-and-trade program, including cement plants, refineries, oil and gas production, and others.

To apply the cap-and-trade program effectively and comply with the requirements of AB 32, the potential for emissions "leakage" must be considered. While important for all sectors, the assessment of the risk of leakage for industrial facilities must particularly consider the potential for production to shift to outside of California or outside of WCI. California and the WCI Partners are examining these risks, and are working to identify approaches for mitigating leakage potential, thereby ensuring that production in California and the WCI Partner jurisdictions remains competitive and real emissions reductions are achieved.

By setting a limit on the quantity of greenhouse gases emitted, a well-designed cap-and-trade program will motivate GHG reduction from industrial facilities that are expected to be the most cost effective options available from these sources.

The WCI program design for the cap-and-trade program includes fugitive methane emissions to the extent that adequate quantification methods exist. During implementation of this measure, ARB will determine whether these emissions will also be covered in California's cap-and-trade program. If the emissions are covered under the cap, ARB will evaluate the need for the measures described here.

(I-1) Energy Efficiency and Co-Benefits Audit for Large Industrial Sources

This measure would apply to major industrial facilities with more than 0.5 $MMTCO_2E$ per year of emissions of greenhouse gases and be implemented through a regulation adopted by ARB. In general, these facilities also have significant emissions of criteria air pollutants, toxic air pollutants, or both. Major facilities that have this level of emissions include larger power plants, refineries, and cement plants. Rulemaking will be initiated in 2010 and the measure will be in effect by 2012, with results potentially available to ARB as early as 2013. This rulemaking will

occur independently of any others, and will not affect rulemakings for criteria pollutants, the cap and trade program, or others.

In California, the 2004 emissions inventory shows that there are 54 major industrial facilities with emissions greater than 0.5 $MMTCO_2E$. The breakdown includes five major oil and gas facilities, two hydrogen plants, one minerals facility, 13 refineries, nine cement plants, 23 power plants, and one natural gas compressor station. The five oil and gas facilities are located in the western Kern County oil fields and are distributed sources but are each treated as a single stationary source; the other facilities are located at single sites throughout California. The emissions range from about 5 $MMTCO_2E$ to just over 0.5 $MMTCO_2E$. The total emissions associated with these facilities are about 77 $MMTCO_2E$, which represents about 80 percent of the total emissions from the industrial sector.

Each facility would be required to conduct a certified, independent, third-party audit of significant individual sources within the facility to determine the potential to reduce greenhouse gases, criteria air pollutants, and toxic air pollutants. The one time audit would include an assessment of the impacts of replacing or upgrading older, less efficient units such as boilers and heaters, or replacing the units with combined heat and power units, and the results submitted to the Board. For example, the audit might identify specific sources within a facility that are old, inefficient, are cost-effective to control directly, and have significant emissions of criteria air pollutants, toxic air pollutants, or both.

The analysis would identify the potential emission reductions, the costs, the cost-effectiveness, the technical feasibility, and the potential to reduce air pollution impacts on local populations. ARB will use the results of the audit to determine if certain emission sources within a facility have cost-effective GHG reduction options that also provide significant reductions in other pollutants. The results of these audits will be useful to the facility in determining where improvements can be made to assist in meeting the requirements of the market system. Also, where the results of the audits indicate that regulatory strategies are warranted, rule requirements, permit conditions, or other mechanisms would be considered to implement the best combination of reductions in GHGs, toxics, and criteria pollutants. The estimated one time cost for the measure is approximately $13.5 million, based on an estimated average audit cost of $250,000 per facility applicable to approximately 54 facilities.

Appendix C: Industry
Table 24

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
Energy Efficiency and Co-Benefits Audits for Large Stationary Sources	TBD	TBD	ARB	2010/2012

A. OIL AND GAS PRODUCTION

California has a large oil and gas industry, which produced approximately 250 million barrels of crude oil and 325 billion cubic feet of natural gas in 2005. This production comes from California's more than 50,000 oil and 1,500 gas wells, including off-shore platforms. The majority of the oil wells are located in southern California, with most of the gas fields located in northern California.

An extensive network of pipelines within the state brings California crude from import terminals and onshore and offshore oil fields to refineries, and distributes finished fuels to more than 70 product terminals throughout the state. Pipelines are also part of the regional petroleum market. California refineries supply Nevada with almost 100 percent of its transportation fuels. Arizona gets more than 60 percent of its fuel from California, while Oregon depends on California's refiners for 25 to 35 percent of its fuel.

The industry is dominated by large, integrated oil companies. While small businesses comprise a large number of individual production wells, their share of total production is modest. There is some evidence that with the current high oil prices, more small producers are entering or reentering the market, resulting in increased emissions.

(I-2) Oil and Gas Extraction GHG Emission Reduction

This measure would address fugitive emissions from the extraction process of California's large oil and gas industry, including on and off-shore sources. Fugitive emissions—mostly in the form of methane—account for approximately five percent of the GHG emissions from this part of the sector and are estimated to be 0.3 $MMTCO_2E$ in 2020. These emissions are from well and process equipment venting: leaks of flanges, valves and other fittings on the wells and equipment; and from separation and storage units such as sumps and storage tanks. This level of emissions follows the historical trend of statewide extraction rates. However, increases in crude oil prices have resulted in increased oil extraction and may increase emissions. If so, this measure would yield greater benefits. This measure may also eventually address combustion sources that are not captured by the Cap and Trade Program.

Controls for the fugitive sources range from applying simple fixes to existing technologies, to deploying new technologies to replace inefficient equipment and detect leaks and would include: improving operating practices to reduce emissions when compressors are taken off-line; installing compressor rod packing systems; substituting high bleed with low bleed pneumatic devices; improving leak detection; installing electronic flare ignition devices; replacing older equipment (flanges, valves, and fittings); and installing vapor recovery devices. These are proven technologies in the U.S. EPA's Natural Gas operations efficiency program, or STAR program, that will pay back investments in a short period of time through saleable gas savings.

The measure described here is expected to reduce fugitive methane emissions by approximately 0.2 $MMTCO_2E$ per year, beginning in 2015 and continuing to 2020 and beyond. Staff estimated the fugitive emission reductions by applying the natural gas savings from the STAR program actions described above to a number of such units in the current emissions inventory. These emission reductions may be underestimated if an industry survey reveals that there are additional sources of emissions.

ARB staff estimates that implementing this measure would result in significant cost savings due to the energy savings. Capital costs are estimated to total $800 thousand with net annualized costs savings of about $3.7 million. There is a potential for further reductions from this measure and these potential reductions will be evaluated as part of the ongoing evaluation of the sector.

(I-3) GHG Leak Reduction from Oil and Gas Transmission

This measure addresses emissions from the transmission and distribution of natural gas throughout California. Statewide, there are approximately 12,000 miles of pipeline for natural gas. Transmission-related emissions come primarily from fugitive sources and secondarily from combustion sources. Approximately ninety-five percent of the emissions from this part of the sector are from methane. These emissions are from venting, accidental releases of GHGs, and leaks of flanges, valves and other fittings along pipelines.

This measure would include improving operating practices to reduce emissions when compressors along the pipeline are taken off-line, as well as installing compressor rod packing systems and replacing older equipment (flanges valves and fittings) along the pipelines. The measure would be based, to a large degree, upon the U.S. EPA's Natural Gas STAR program aimed at cost effective approaches to reducing methane emissions. This measure may also eventually address combustion sources that are not captured by the Cap and Trade Program.

Total fugitive emissions from natural gas transmission are estimated to be 1.7 $MMTCO_2E$ in 2020. The measure described here is expected to reduce fugitive methane emissions by approximately 0.9 $MMTCO_2E$ per year. Staff estimated the fugitive emission reductions by applying the natural gas savings from the U.S. EPA's Natural Gas STAR program actions described above to a number of such units in the current emissions inventory. These emission reductions may be underestimated if an industry survey reveals that there are additional sources of emissions.

ARB staff estimates capital costs to be about $24 thousand, with annualized net savings of about $17 million. Implementation of this measure would impact mainly the natural gas industry and have little or no impact on the price of end products as the annual savings exceeds the capital costs and annual operating and maintenance costs. Because of the cost savings, there is a potential for further reductions from this measure and these potential reductions will be evaluated as part of the ongoing evaluation of the sector.

Appendix C: Industry
Table 25

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Oil and Gas Extraction GHG Emission Reduction	0.2	-3.7	ARB	2011/2015
GHG Leak Reduction from Oil and Gas Transmission	0.9	-17	ARB	2010/2015

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

B. REFINERIES

The GHG emissions from refineries in the state are estimated to be 35.2 $MMTCO_2E$ (2004), including emissions from hydrogen production. Increased energy efficiency could produce significant emission reductions in this sector. Establishing leak controls for methane would also result in GHG reductions.

California is the third largest refining state in the nation, with 21 refineries located primarily in the San Francisco and Los Angeles regions. These facilities produce approximately 80 million gallons of refined product per day.[119]

It is unlikely that refinery production will decrease in California over the next 12 years because of GHG reduction requirements. Due to the State's proximity to existing infrastructure (seaports, pipelines, etc.) and the developing Low Carbon Fuel Standard (LCFS)—which will hold both in-state and out-of-state producers to the same low carbon fuel standard—the demand for fuel products from California's refineries will not significantly change in the short term.

(I-4) Refinery Flare Recovery System Improvements

In a refinery, flares are combustion devices, usually elevated, that are designed to safely dispose of flammable gases generated in processing units during emergency conditions or during normal, planned maintenance. A series of piping manifolds directs the gases to the flare.

While the main purpose of the flare system is to protect the refinery and surrounding community from potential catastrophic overpressure in the process units, the combustion of gases in flares results in emissions of nitrogen oxides (NOx), sulfur oxides (SOx), some unburned hydrocarbons, and greenhouse gases (GHG).

A flare gas recovery unit can minimize emissions from the flare by recovering the gases before they are combusted by the flare. The system collects the gas, compresses it, cools it, and then sends it back to a refinery process, where the recovered gas can be used as refinery fuel gas or refinery feedstock. In order to achieve the optimum performance, the flow of waste gases should be less than or equal to the capacity of recovery system.

[119] California Energy Commission, 2008; From Web site: www.energy.ca.gov/oil/refineries.html

Staff proposes to improve the overall flare gas recovery in the flare systems of California's refineries by increasing compressor capacity where practicable. Furthermore, staff will evaluate connecting to the flare system pressure-relief valves that currently release to the atmosphere.

Staff assumed that installing an additional compressor in the flare system, at a cost of $3.75 million apiece, at 19 of the 21 refineries would result in a total estimated capital expenditure of $71.3 million. The additional gas-recovery capacity would then be sufficient to handle sizable flare events that would have exceeded the capacity of the old systems. The recovered gases would be utilized in the refineries, resulting in cost savings. Staff assumes that flare emissions would be halved by this measure.

(I-5) Removal of Methane Exemption from Existing Refinery Regulations

Under this measure, existing fugitive methane exemptions would be removed from the regulations applicable to equipment and sources employed in California's refineries. The local air pollution control authorities oversee and implement regulations which limit and monitor refinery fugitive emissions. Methane is currently exempted from local fugitive emissions regulations because it is not a volatile organic compound (VOC) that contributes to urban ozone levels. Storage tanks, wastewater treatment facilities, and process losses (leaks) are all sources of fugitive emissions which contain methane. Valves, pumps, compressors, pressure relief valves, flanges, connectors and other piping components are especially vulnerable to leakage. To implement this measure, ARB would work with the local air pollution control authorities to:

- Modify existing regulations to include in addition to VOCs, methane detection and leak repair as a regulatory requirement;
- Ensure that components that contain significant amounts of methane are included in fugitive emissions monitoring programs, and increase the fugitive methane monitoring frequency of all identified components; and
- Modify leak detection methodology and equipment requirements to detect methane, and where needed, require the installation of additional leak detection equipment.

The measure described herein is expected to reduce GHGs emissions between 0.01 and 0.05 $MMTCO_2E$ per year in 2020. This measure is expected to eliminate approximately 85 to 90 percent of fugitive methane emissions. Additional analysis is needed to more accurately quantify actual refinery methane emissions.

Based on data provided by the South Coast Air Quality Management District and the Bay Area Air Quality Management District, ARB estimates that the annual costs for implementation of this measure to be about $5,000,000. Staff assumed that, of the estimated 650,000 valves in the 21 California refineries, five percent were not being inspected due to the methane exemption in current local air district rules. Annual inspection costs for these 32,500 valves would be $1.6 million. Assuming one percent of valves and five percent of other devices need to be repaired at $50/repair and 0.5 percent of devices need replacement—at $10,000 per replacement—an additional $1.7 million cost is incurred. When methane leaks are minimized, savings will occur, and the gas captured as a result of this measure will result in an energy savings valued at $2.7 million. Therefore, total annual costs are estimated at $0.6 million. Implementation of these regulations will require close coordination with local air districts, but should not impact entities

beyond the refining industry. This measure should have little or no impact on the price of refined end products.

The benefits and costs of the refinery-based GHG-reduction measures described in this section are summarized in the below.

Appendix C: Industry-Recommended Actions
Table 26

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Refinery Flare Recovery System Improvement	0.33	-39	ARB	2010/2012
Removal of Methane Exemption from Existing Refinery Regulations	0.01	0.6	ARB	2010/2012

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

9. RECYCLING AND WASTE MANAGEMENT

This Sector includes the following measures:

<u>Recommended Actions</u>
(RW-1) Landfill Methane Control Measure (Discrete Early Action)
(RW-2) Increasing the Efficiency of Landfill Methane Capture
(RW-3) High Recycling/Zero Waste: Commercial Recycling, Composting and Other Organics Products, Anaerobic Digestion, Extended Producer Responsibility, Environmentally Preferable Purchasing

<u>Areas of Research/Opportunities for future GHG Emission Reductions</u>:
Liquefied Natural Gas (LNG) from Landfill Gas

ARB worked closely within the Recycling and Waste Management (R&WM) CAT subgroup in developing these measures. This input was evaluated and analyzed by ARB and is reflected in the measures included in this sector.

Overview

The Recycling and Waste Management sector includes the state's solid waste facilities (such as landfills, material recovery facilities, and transfer stations), composting infrastructure, and recycling industries. When organic materials, construction materials and other municipal solid wastes are discarded, they end up in landfills. In California however, much of the waste is turned into renewable resources and in the process, California realizes significant greenhouse gas (GHG) emission reductions. Increasing waste diversion from landfills beyond the current rate of 54 percent (which exceeds the 50 percent mandate) provides additional recovery of recyclable materials that will directly reduce GHG emissions. Recycled materials can reduce the GHG emissions from multiple phases of product production including extraction of raw materials, preprocessing and manufacturing. Furthermore, use of composted organic materials provides environmental benefits such as carbon storage in soils and reduced use of fertilizers, pesticides, and water, rather than placing these materials into a landfill to decompose into methane and other gases.

The 147 active landfills in the state are owned by private companies, mostly large waste disposal companies, or by municipalities. Closed landfills are scattered throughout the state and once provided service to specific localities. Other types of waste facilities, such as compost facilities, transfer stations, or material recovery facilities, handle diversion of reusable materials (organic materials, traditional recyclables like paper, plastic, glass, metals, and construction materials).

Per the Statewide GHG emissions inventory, the largest emissions from the Recycling and Waste Management sector come from landfills and are in the form of methane, which is produced when materials placed in landfills decompose over time. Often, decades elapse and methane is still produced from this decomposition. Although methane is captured currently at many large landfill sites, there are still active landfill operations and closed landfill sites that continue to emit methane that could be captured. ARB staff worked with the Recycling and Waste Management Subgroup of the Climate Action Team to develop measures to reduce landfill methane emissions.

ARB identified improved capture of landfill methane as a Discrete Early Action Measure. Methane that is currently emitted can be captured and further controlled, and can, in some cases, be used as a fuel to replace conventional fossil fuels. In addition, methane capture can also reduce air quality impacts by capturing and destroying volatile organic compounds and other landfill gases that are emitted during the decomposition process. ARB staff is working closely with the California Integrated Waste Management Board (CIWMB) to develop this measure which ARB will consider in early 2009.

In addition, the sector team identified a series of other measures that are currently non-regulatory, but would aid in the overall reduction of GHG emissions from the sector. Implementation of landfill gas best management practices, increased production and markets for compost and other non-ADC beneficial uses of organic materials, commercial recycling, extended producer responsibility and environmentally preferable purchasing, and deployment of anaerobic digestion for production of fuels/electricity from biomass were all included in the staff recommendation to consider for the Scoping Plan.

The diversion of organic material from landfills can provide a significant reduction in GHG through landfill methane avoidance, alternative energy production and water conservation. The CIWMB is undertaking efforts to increase production and markets for compost and other organics products including development of a complete life cycle assessment of organic diversion alternatives; development of compost-based best management practices, compost specifications for agriculture, and a study examining the effectiveness of using compost as cover material to mitigate methane from landfills. The use of organic waste as an alternative daily cover (ADC) by landfills is another unique issue. ADC used by landfill operators is currently counted toward local waste diversion goals, which can result in competition for this material as feedstock for compost; this policy is under review by CIWMB.

Extended producer responsibility and commercial recycling are additional ways to address GHG reductions. Extended producer responsibility would address the problem that many items are now produced without regard to their end-of-life disposition. Promoting commercial recycling would increase the rate of removing recyclables from the waste stream for efficient reuse. If more products are recyclable and are designed with an eye toward their end-of-life disposal, significant amounts of GHG could be realized. Some of the benefits of extended producer responsibility and most of the benefits of increased commercial recycling would likely accrue outside of California making emissions accounting more challenging. This measure would reduce both co-pollutants and global GHGs and would move towards the CIWMB's goal of a sustainable California where all resources are conserved to the maximum extent feasible. While most of the recycling and manufacturing may occur outside of California, some does occur in the state (e.g. glass, paper, and plastics manufacturing) and it is likely still significant.

CIWMB also identified technologies and outreach that would improve emission reduction through voluntary strategies. One method involves increasing the use of anaerobic digestion, a type of controlled, in-vessel decomposition of the organic fraction of the waste stream that allows for renewable energy production and avoidance of landfill methane emissions. Another method includes increasing outreach efforts on best management practices for efficient landfill operating practices to minimize the release of landfill gases and provide tools for landfill operators to move towards methane capture ahead of any regulatory deadlines. These best management practices could be used at smaller and closed landfills to reduce fugitive methane

releases and would also provide tools and costs to consider in the event that the methane controls could be applied even though their amount of waste-in-place might exempt them from the requirements.

Opportunities for emission reductions as well as diversion benefits also exist through design measures. For example, the Green Buildings section of the Scoping Plan identifies measures designed to reduce construction and demolition waste. This may potentially aid the Recycling and Waste Management sector in the reduction of GHG emissions in addition to further increasing diversion of waste materials.

Recommended Actions

A. LANDFILL METHANE CAPTURE

(RW-1) Landfill Methane Control Measure (Discrete Early Action)

Enhanced control of methane emissions from municipal solid waste landfills will require owners and operators to install gas collection and control systems at smaller and other uncontrolled landfills. Additionally, all affected landfills will be required to satisfy enhanced methane monitoring requirements to ensure that their gas collection and control system is operating optimally and that fugitive emissions are minimized.

The Landfill Methane Control Measure is a discrete early action measure and is currently in the regulatory development process. The measure will be fully adopted by January 1, 2010, but will likely have a phase in period to become fully effective. The preliminary one-time estimated cost for adoption is approximately $70 per ton of CO_2 reduced. Capital cost was estimated to be approximately $3,440,000 and annual operation cost of approximately $706,400 per landfill. Total industry costs estimates will be discussed in the staff report for the landfill methane control measure.

Appendix C: Recycling and Waste Management
Table 27

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
RW-1: Landfill Methane Control Measure (Discrete Early Action)	1.0	52 (approximately 1 per landfill)	ARB	Board Hearing Early-2009

B. ADDITIONAL REDUCTIONS IN LANDFILL METHANE

(RW-2) Increasing the Efficiency of Landfill Methane Capture

To support the landfill methane control measure (RW-1), CIWMB recently published a guidance document titled “Technologies and Management Practices for Reducing Greenhouse Gas

Emissions from Landfills" that can be used as an outreach tool to optimize and increase the efficiency of landfill methane capture. Implementation of the options described in this guidance document may further reduce emissions from landfills and improve gas collection efficiencies beyond the control measure. Emission reductions are site specific and therefore cannot be quantified. ARB and CIWMB will work together to assess the need for regulatory action to mandate any specific options, as appropriate, at California landfills.

Appendix C: Recycling and Waste Management
Table 28

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
RW-2: Increasing the Efficiency of Landfill Methane Capture	TBD	TBD	CIWMB	TBD

(RW-3) High Recycling/Zero Waste

Mandatory Commercial Recycling

The commercial recycling measure focuses on increased commercial waste diversion. There are about 24,000 commercial businesses in California that generate over half of the statewide solid waste. Reductions in GHG emissions can be realized from solid waste management by recovering traditional recyclable materials from the commercial waste stream with the goal to remanufacture these materials, thus reducing the GHG emissions from multiple phases of product production including extraction of raw materials, preprocessing and manufacturing. Traditional recyclable materials have significant intrinsic energy value that displaces fossil fuel energy requirements when introduced back into the manufacturing cycle.

Not all of the reductions from the commercial recycling measure will occur in California, making accounting more difficult. Benefits from the commercial recycling measure include avoided methane emissions from landfill disposal by recycling any organic materials from the waste stream. Economic studies are planned to investigate the potential for commercial recycling.

Composting and Other Organics Products

Various activities for increasing the production and markets for compost, mulch, and biofuels/energy and diverting these organic materials from landfills are being pursued as measures in this sector. Diversion of organic materials can provide a significant reduction of GHG through landfill methane avoidance. Additional GHG emission reductions are achieved through reduced water consumption and fertilizer production resulting in energy savings in pumping irrigation water and manufacturing and transporting fertilizer. CIWMB efforts to increase the production and markets for compost and other beneficial uses include an Economic and Life Cycle Assessment of Organic Diversion Alternatives; compost-based best management practices; development of compost specifications for agriculture; and a study examining the effectiveness of using compost as cover material to mitigate methane from landfills. However,

because composting facilities emit Volatile Organic Compounds (VOCs), which are criteria pollutants that contribute to ozone formation these facilities may have some region-specific (e.g.. San Joaquin Valley) air district permitting requirement issues. There is a need for research on emissions and best management practices to fill knowledge gaps and uncertainty regarding emissions from compost facilities.

Anaerobic Digestion

Anaerobic digestion is a type of conversion technology that diverts organic materials from the waste stream to be utilized as feedstock for a digestion process that produces energy and displaces fuel or energy derived from fossil fuels in a sustainable manner. This measure would seek to increase anaerobic digestion of green waste, food waste and other organic components of the waste stream. Typically the methane gas produced by the anaerobic digestion process is converted into LNG, compressed natural gas (CNG), or electricity for on-site energy needs and export to the energy grid. In addition to GHG reductions, this measure also results in the production of 1.2 million MWh of renewable energy on an annual basis.

This measure will also seek to expedite the deployment of GHG reducing technologies by providing funding that assists developers in demonstrating their technology for commercialization of emerging conversion technologies that maximize the front-end recovery of materials for recycling, meet strict cross-media performance standards to protect public health, safety and the environment and result in a net reduction in GHG emissions.

Benefits from these measures include avoided methane emissions by increasing waste diversion of organic materials from landfills and development of a biomass renewable energy sources. Executive order S-06-06 directs State agencies participating in the Bio-energy Interagency Working Group to enhance the sustainable management and development of biomass resources for electricity generation and production of alternative fuels (bio-fuels).

Extended Producer Responsibility and Environmentally Preferable Purchasing

Extended producer responsibility is a strategy to place a shared responsibility on the producers, and all entities involved in the life cycle of a product for reducing the health and environmental impacts that result from supply chain, production, use, and end-of-life management of a product. A major component of this measure includes product design changes that minimize a negative impact on public health and the environment at every stage of the product's lifecycle. By implementing extended producer responsibility additional environmental benefits could also be realized such as reductions in air emissions and water pollution along with waste minimization. Environmentally preferable purchasing (EPP) can reduce the quantity of energy consumed through the production and use of products in addition to reducing the quantity and toxicity of waste in California by purchasing recycled, repairable, and durable goods. This concept provides the State an opportunity to lead by example in reducing GHG emissions.

Appendix C: Recycling and Waste Management
Table 29

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)	Proposed Lead Agency	Adoption/ Implementation Timeframe
RW-3: High Recycling/Zero Waste[120]				
Mandatory Commercial Recycling	5.0[121]	TBD	CIWMB	TBD
Increase Production and Markets for Composting and Other Organics Products (studies underway for data development)	2.0[122]	TBD	CIWMB	TBD
Anaerobic Digestion[123]	2.0	TBD	CIWMB	TBD
Extended Producer Responsibility	TBD	TBD	CIWMB	TBD
Environmentally Preferable Purchasing	TBD	TBD	DGS	TBD

C. AREAS OF RESEARCH/OPPORTUNITIES FOR FUTURE GHG EMISSION REDUCTIONS

Liquefied Natural Gas (LNG) from Landfill Gas

This activity implements grant-funded projects at two landfills to demonstrate commercial scale technologies for converting landfill gas to LNG vehicle fuel. Recovery of landfill methane that is combusted through flaring can be captured as a biomass renewable energy source. Executive order S-06-06 directs State agencies participating in the Bio-energy Interagency Working Group to enhance the sustainable management and development of biomass resources for electricity generation and production of alternative fuels (bio-fuels). However, substantial financial and technical barriers exist for in-state production of LNG from landfill gas. The technology transfer

[120] These measures represent the lower bound of the GHG estimates provided by CIWMB.
[121] Some GHG reductions may occur outside of California making accounting more difficult, additional research to quantify emission is needed
[122] Preliminary estimate by CIWMB, based on 50% diversion of compostable organics from landfills. CIWMB is currently developing a GHG tool to refine GHG reduction estimate.
[123] For anaerobic digestion, GHG reductions include only methane avoidance at landfills; however this measure also contributes 1.2 million MWh in renewable energy production. This measure does not include other waste-to-energy technologies.

from these commercial projects, which are expected to conclude in June 2009, could provide significant GHG reduction opportunities.

10. FORESTS

This sector includes the following measures:

Recommended Actions
(F-1) Sustainable Forest Target
- **Regulatory and Statutory Capacity**

Forest Practice Rules Mechanism
CEQA Mechanism

Opportunities for Additional Reductions
Forest Conservation
Forest Management
Afforestation/Reforestation
Urban Forestry
Fuels Management

ARB worked closely with the CAT and its sector-specific subgroups in developing the measures included in this Plan. This input was evaluated and analyzed by ARB and is reflected in the measures included in this sector.

Overview

California's forests play a critical role in the State's carbon balance, with the unique capacity to remove CO2 from the air and store it long-term as carbon. The forest sector is the only sector included in the Scoping Plan that provides a net removal of GHGs.

Under the Sustainable Forest Target (Measure F-1), Board of Forestry and Fire Protection will use its existing authority over sustainable forestry, post-harvest restocking, fire hazard reduction and fire safety, timberland conversion, and existing forest improvement assistance programs to ensure sustainable management practices and, at a minimum, to maintain current carbon sequestration levels. Coordination of these efforts with federal forest land managers is essential to the target of maintaining carbon sequestration levels. Other opportunities exist to not only maintain but enhance the capacity for forests to sequester and store more carbon through measures such as additional voluntary actions, offsets, expanded assistance programs and markets.

Current net forest sector emissions are approximately -5 $MMTCO_2E$ (2002-2004 average). This net number is negative because the gross emission rate from disturbances such as fires, harvesting, land conversion, and decomposition of wood and other forest products is less than the gross atmospheric uptake and sequestration of carbon from forest growth. Forests also provide multiple ecological benefits (for example, habitat, structure, and nutrient cycling), as well as a suite of other human benefits or services on which we depend (for example, water storage, soil stability, air and water quality, wood products, and recreation).

The 33 million acres of forest land in California cover one third of the State. Ownership is split about evenly between the public and private sectors. Fifty-two percent of forest land is managed

by the federal government, 45 percent by private landowners, and 3 percent is managed by the State. Stakeholders in the forest sector consist of private landowners, public land managers, non-profit organizations, agencies, local governments, and community-based groups. Forests can be characterized as tree-dominated landscapes which can support greater than ten percent tree canopy cover and include forestlands, woodlands, urban forests, and rangelands. The forest sector also includes all primary wood products, as well as wood fiber for bio-energy.

Recommended Actions

(F-1) Sustainable Forest Target

This measure recognizes that the current abundance of forest carbon stock in California is, in part, a result of rigorous forest practice rules that tightly control forest management across the State. The California Forest Practice Rules are the most stringent in the country. The goal of the Sustainable Forest Target is to maintain the current net forest sink of -5 $MMTCO_2E$ through 2020, using the mechanisms provided by the Forest Practice Rules, timberland conversion regulations, fire safety requirements, and forest improvement assistance programs, as well as the California Environmental Quality Act (CEQA) which mandates avoidance or mitigation of forest carbon losses to conversion. Establishing a sequestration target resonates internationally—deforestation is recognized as the single largest contributor to global GHG emissions—while also setting a precedent for the rest of the land base.

Regulatory and Statutory Capacity

Forest Practice Rules Mechanism: Regulatory actions that affect carbon sequestration on private forest lands are enforced through the California Forest Practice Rules by the California Board of Forestry. For example, Forest Practice rule changes implemented in December 2004 will produce an additional annual 2.2 $MMTCO_2E$ reduction in 2020. The Board of Forestry and Fire Protection in conjunction with the Resources Agency, the California Department of Forestry and Fire Protection, and the Air Resources Board will evaluate how current regulations and programs address GHG emissions so that it can ensure achievement of the 5 $MMTCO_2E$ target. This assessment includes updating approaches to estimating the annual forest inventory, developing a statewide forest carbon monitoring and assessment plan, and a re-assessment of the current regulatory framework in the context of carbon benefits.

CEQA Mechanism: Private lands are strongly influenced by development pressures. Local Government has the primary land use authority under the CEQA and Government Code. While local government has land-use authority for non-timber lands, the Board of Forestry and Fire Protection has pre-emptive land use authority for timberland where the land use is to be changed to a non forest management use. The Public Resources Code (PRC 4621 et.seq.) requires Timberland Conversion Permits (TLC) where the land use change will occur, and these permits are subject to CEQA. The CEQA process provides further authority for the conversion permit process to require mitigation for these projects. Regulatory changes for the TLC process could help direct conversion away from forest lands that provide net GHG benefits and identify potential mitigations. CEQA guidelines are being revised to ensure evaluation of GHG emissions and climate change impacts which will strengthen the ability to require mitigation for the loss of carbon stocks through the conversion of timberlands.

California forests face the additional threat of the impacts of global warming. Uncertainty about how much the climate will change and how feedbacks will affect forests make it particularly difficult to predict future emissions for this sector. Achieving the goal of 5 $MMTCO_2E$ from the Forest sector by 2020 will require active participation by the private sector and local, state, and federal governments to fully implement. Jurisdiction or authority issues are a function of the land base and the specific actions needed to achieve the GHG benefits. Land-use conversion, and its impact on emissions, links the forest sector to the Land-Use and Local Government sectors under the Scoping Plan.

Appendix C: Forests
Table 30

Reduction Strategy	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Sustainable Forest Target	5	50	Board of Forestry and Fire Protection	Ongoing

Opportunities for Additional Reductions

There are additional greenhouse gas reduction opportunities which can enhance the capacity of forests to sequester and store carbon in addition to the sustainable forest target and they include:

1) Forest Conservation
2) Forest Management
3) Afforestation/Reforestation
4) Urban Forestry
5) Fuels Management

The five opportunities for additional reductions above could potentially produce another 2 $MMTCO_2E$ benefits in 2020 over and above the 5 MMT sustainable forest target. Conservation and forest management approaches are already underway, and will provide reductions in 2020 through proposition funds 40, 50, and 84. Investment in afforestation/reforestation in the near-term will lead to significant long-term benefits of more than 23 $MMTCO_2E$ per year by 2050, though site preparation activities may result in emissions in 2020. Offset market opportunities for forest management activities have been identified for about 0.5 $MMTCO_2E$ of the total 2 $MMTCO_2E$ annual benefits in 2020 and up to 13 $MMTCO_2E$ in 2050 from both reforestation and forest management. The adoption of additional forestry protocols for actions under other strategies may enhance GHG benefits from markets. Strengthening the funding base for the California Forest Improvement Program (CFIP) will provide future consistency to support ongoing afforestation/reforestation and potentially emission reducing fuels treatment activities. Increased activity across the State, and the associated GHG reductions, could be maintained if the CFIP program funding were more continuous.

California's forests will play a role in the State's goal of reducing emissions but given the inherent uncertainty in quantifying emissions and sequestration in this sector, especially with

climate change, additional research and the development of pilot projects and quantification tools are necessary. Emissions reductions under this sector will require active participation by private landowners and local, state, and federal governments to fully implement and realize maximum GHG benefits. Strategies in the Forest sector will interact with those in other sectors including land use, waste management, agriculture, water, and electricity. Investing in research and quantification tools will be necessary to improve inventory and modeling accuracy.

Reduction Opportunity: Forest Conservation

California forests and woodlands continue to be developed and converted to non-forest uses. Cal Fire's Fire and Resources Assessment Program (FRAP) projects a conversion of 312,000 acres of forestland and 258,000 acres of woodlands between 2000 and 2020. In addition to residential and industrial development, forests and woodlands may also be converted for roads, power lines, rail, pipelines, agriculture and rights-of-way.

Tools available to prevent or mitigate conversion include land use planning, conservation easements, and mitigation banking. Agencies or non-governmental organizations may buy or accept donations of forestland (fee title) easements or other interests to preserve and enhance them for forest uses such as habitat, recreation, community forestry, and timber management. When easements or other interests are sold or donated, the landowner can have the property assessed for the purposes of lowering their tax liability. To ensure carbon sequestration over the long term, these forest and woodland land purchases generally require permanent retirement of development rights, preclude uses that would reduce carbon stocks or sequestration capacity, and include management geared toward maintaining or increasing carbon sequestration through conservation management projects. Mitigation banking for land conversion through tree planting is quantified under the Afforestation/Reforestation strategy

The following implementation approaches have already been funded or have a high likelihood of securing funding.

- Proposition 40 and 50 purchases of forest and woodland in 2005 and 2006: This implementation approach protected forests and woodlands from conversion through fee title or easements. These forests will continue to produce GHG benefits in the future as they mature.
- Proposition 84 purchases to conserve forest and oak woodland habitats
- Future funding: This measure assumes funding for forest and woodland conservation projects that is comparable to Proposition 84.

Reduction Opportunity: Forest Management

There are significant opportunities to increase the carbon storage on managed forest lands over the next few decades by increasing forest growth through healthy and fully stocked stands that utilize site potential for growth while resisting or minimizing emissions from fire, insects and disease. Stands on timberlands statewide are growing at approximately 2.4 percent per year and this represents about 70 to 75 percent of their potential. Many of the timberland owners in California could make voluntary choices to manage their forestlands at a level above the minimums of the Forest Practice Rules.

Implementation approaches include:

- Riparian Zone Extension: The voluntary extension of existing riparian protection zones currently required by the Forest Practice Rules.
- Timber Stand Improvement: These activities include 1)restoring conifer areas to full productivity by reduction of undesirable species and restocking with native species, 2) thinning stands to increase the growth rate for remaining trees, 3) optimizing rotation age from a carbon life cycle perspective, 4) planting additional trees where the existing stocks are not fully utilizing the biological potential of the site. The additional value of the carbon will provide the incentive for the private landowners to make the additional investment in their lands to better utilize the growth potential.

Reduction Opportunity: Afforestation/Reforestation

Forest activities can have both near-term and long-term GHG benefits. Tree planting has very significant long-term benefits. FRAP analysis shows that afforestation/reforestation planting activities over the next decade may reap more than 23 $MMTCO_2E$ annually by 2050. However, the near-term benefits provided by planting seedlings are minimal, since the removal of brush and replanting of trees initially produces a small increase of emissions.

Afforestation is the establishment of a forest in an area where the preceding vegetation was not forest. Reforestation is the establishment of native tree cover on lands that were previously forested, but have had less than ten percent tree canopy cover for a minimum of ten years.

Afforestation/reforestation emission reductions can be implemented through a number of separate approaches that cumulatively increase the acres of land that are forested annually. Implementation approaches include:

- CFIP: The California Forest Improvement Program administered through Cal Fire authorizes the Department to provide technical and other assistance (cost share funding) to private landowners with ownerships 5,000 acres and under. Through additional funding the existing cost share program would be able to increase the amount of afforestation and reforestation that is done on private lands.
- State land reforestation: On state lands, authority exists to implement afforestation/reforestation projects.
- Federal land reforestation: On U.S. Forest Service and other public lands, federal agencies have the authority to implement afforestation/reforestation projects.
- Mitigation: This measure analyzes potential GHG benefits of having CalFire and local government require reforestation mitigation of forest and woodland converted.
- Offset Program: Developing a market for GHG offsets will encourage landowners to reforest areas currently occupied with brush and other vegetative communities and to implement other conservation forest management practices.

Reduction Opportunity: Urban Forestry

Urban forestry can create GHG benefits through planting trees in urban areas by 1) sequestering carbon, 2) reducing energy demand due to shading, and 3) providing biomass for fossil fuel alternatives from urban “green” waste. Urban forests provide many co-benefits, such as reducing stormwater runoff, increasing property values, reducing VOC emissions, providing social benefits, among others. Many cities and organizations are actively involved in tree planting to expand the role of urban forests. In areas where urban development interfaces with

wild lands individual land owners are also engaged in tree planting and various forms of vegetation management affecting fire risk reduction, forest carbon sequestration, and energy savings.

Urban forestry projects are already being implemented through government actions and voluntary planting on private property and potentially could result in the planting of over nine million trees through 2010 using voluntary and incentive programs.

The implementation approaches include:

- Agency planting: The State supports efforts by private and public landowners, non-profit organizations, and local governments in urban areas to keep planting suitable species of trees in strategic locations to provide maximum benefits of shade, minimal long-term care costs, and low capacity to emit smog-forming constituents.
- Voluntary planting: As voluntary actions, homeowners commonly plant trees on their property for a variety of reasons. Education and marketing can help achieve the strategic planting of these trees to maximize survival and benefits and can result in an additional 1.2 million trees planted annually. Through city and community based organizations there are several major initiatives to increase voluntary tree planting in California.

The GHG emission reductions from sequestration are listed in Table 31. Reductions from shading benefits (reduced air conditioner use) and bio-power, roughly 0.8 $MMTCO_2E$, are not included because they will be reported in the energy sector to avoid double counting.

Reduction Opportunity: Fuels Management

Emission reductions from forest fuels management could be achieved through two implementation approaches.

- State and federal fuels treatment: Fuels management strategies have the potential to reduce the risk of catastrophic fires. However, fuels management needs to be evaluated to determine whether, and if so under what circumstances, quantifiable greenhouse gas emission reductions are achieved.
- Forest biomass for use in bio-power and bio-fuel production: Utilization of forest biomass supports the goals of the Bioenergy Action Plan for California (2005) which targets biomass resources to produce transportation fuels, electricity generation, and biogas including enhancement of the supply of biomass through fuel hazard reduction.

Appendix C: Forests—Opportunities for Additional Reductions Reportable by Forest Sector (Sequestration)††
Table 31

Opportunities for Additional Reductions	**Potential 2020 Reductions $MMTCO_2E$**	**Net Annualized Cost ($ Millions)**	**Proposed Lead Agency**
○ Forest Conservation ○ Forest Management ○ Afforestation/ Reforestation ○ Urban Forestry ○ Fuels Management	Minimum 2	TBD	Cal Fire

†† Over 2 $MMTCO_2E$ in benefits that will accrue in 2020 from Forest Practice Act rules instituted in 2004 are also not included here since they are considered part of the Sustainable Forest Target.

11. HIGH GWP

This sector includes the following measures:

Recommended Actions

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)

(H-3) Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)

(H-4) Limit High GWP Use in Consumer Products (Discrete Early Action)

(H-5) High GWP Reductions from Mobile Sources

- Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems
- Air Conditioner Refrigerant Leak Test During Vehicle Smog Check
- Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers
- Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems

(H-6) High GWP Reductions from Stationary Sources

- High GWP Stationary Equipment Refrigerant Management Program
  - Refrigerant Tracking/Reporting/Repair/Deposit Program
  - Specifications for Commercial and Industrial Refrigeration
- High GWP Recycling and Deposit Program
- Specifications for Commercial and Industrial Refrigeration
- Foam Recovery and Destruction Program
- SF6 Leak Reduction and Recycling in Electrical Applications
- Alternative Suppressants in Fire Protection Systems
- Residential Refrigeration Early Retirement Program

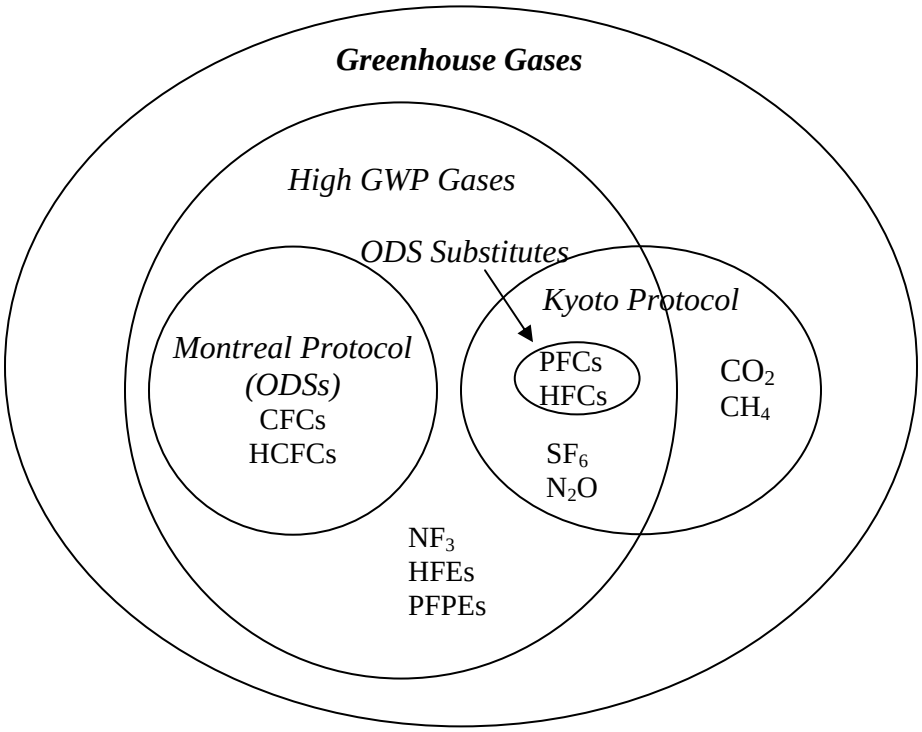
(H-7) Mitigation Fee on High GWP Gases

Overview

While not a discrete sector of the California economy, the High Global Warming Potential (high GWP) sector consists of a broad range of sources that emit gases that have hundreds to thousands of times the climate impact as CO_2. High GWP substances are largely used as refrigerants in stationary and mobile source air conditioning and refrigeration. However, high GWP gases are also used as foam-blowing agents, in electrical transmission, as fire suppressants, in consumer products, and in the semiconductor industry.

High GWP GHGs can generally be categorized as Kyoto Protocol gases, Montreal Protocol gases, and several miscellaneous gases not covered under either treaty.

Appendix C Figure 7



The first category of high GWP GHGs is ozone-depleting substances (ODS), which include chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). ODS production is controlled under the Montreal Protocol as a result of concerns about stratospheric ozone depletion, but emissions are not controlled. The underlying assumption of the Montreal Protocol is that the gases produced will eventually be emitted. However, for some end uses there can be a considerable time lag between gas production and emission. Because ODSs have been used as blowing agents in foams and are stored as refrigerants in various systems, there is a legacy of gases that will be emitted unless recovered, which are referred to as "banks". Currently, ODS banks total over 600 $MMTCO_2E$ in California, even though most production of CFCs in developed nations stopped in 1996. The Montreal Protocol Technology and Economic Assessment Panel (TEAP) estimates that the majority of the CFCs, currently banked will be released to the atmosphere over the next several years unless preventative measures are taken. HCFCs will be produced in developed countries until 2020, and emissions and banks of these chemicals will continue to build until HCFC-22 phase-out begins in 2010.

As a result of the Montreal Protocol's phase-out of ODSs, the gases have been replaced with hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), which are hence called ODS substitutes. Whereas ODSs have negative impacts for both climate change and stratospheric ozone, ODS substitutes are not ozone-depleting but are generally potent GHGs. Along with sulfur hexafluoride (SF_6), HFCs and PFCs are Kyoto Protocol gases and are specifically listed in AB 32.

Other high GWP GHGs include nitrogen trifluoride (NF_3), hydrofluoroethers (HFEs), and perfluoropolyethers (PFPEs). Available information is presently insufficient to quantify the emissions and banks of these gases in California, but it is likely that the quantities are small.

Ozone-depleting substances are not included in California's AB 32 1990 GHG inventory that defines the target for 2020. The majority of ODS substitutes are Kyoto gases and are thus included in the inventory. Emissions and banks of Kyoto Protocol gases are building as ODSs are phased out and are replaced by ODS substitutes. In total, the high GWP sector is currently estimated to represent on the order of 3 percent of the GHG inventory. However, the sector is growing rapidly primarily due to the increased use of substitutes for ODS.

A distinguishing trait of high GWP gases is that they are not used by a distinct economic sector, and that the gases are primarily of interest in the contexts of climate change and, for some gases, ozone depletion. Emissions of high GWP gases are of great importance because of the potency of the substances; for example, one pound of SF_6 has the same effect on global warming as 11 metric tons of CO_2. In addition, banks of high GWP gases and their impending emissions are a unique situation. The combination of non-Kyoto GHGs and Kyoto GHGs leads to intricacies in estimating emission reductions from source categories that are in the inventory for some gases and excluded for others. The Draft Scoping Plan addresses these high GWP gases as a sector, as this is the most convenient method to design an overall emission reduction strategy.

A variety of strategies are being pursued to reduce high GWP GHG emissions at all stages of the life cycle. In the development and production phase, a preferred path to reduce or avoid entirely emissions from high GWP gases is to require and/or promote the use of safe and effective alternatives with either much lower GWP or no global warming impact. Examples of replacement measures include alternative fire suppressants and low GWP refrigerants in new motor vehicle air conditioning (MVAC) systems. For in-use products, measures to limit gas leaks are being pursued such as leak tightness specifications for commercial and industrial refrigeration. At the end of a product's life, measures emphasize recovery of high GWP gases, such as SF_6 recovery from electrical transmission and particle accelerators. Existing banks are targeted for destruction to avoid future emissions.

The low cost of many high GWP GHGs, as well as lack of incentives for emission control, has resulted in the common practice of simply re-charging leaky or poorly designed/maintained systems, or using high GWP GHGs in completely emissive processes. Low costs and the lack of enforced regulations limiting releases have also lead to low recovery and reclamation rates for many high GWP GHGs, meaning that venting occurs during maintenance or end of life disposal.

The high-GWP refrigerant management program—a single measure targeting the issues of refrigerant leak, tracking, reporting, and repair; refrigerant use, sale and disposal is proposed as a key mitigation measure. The aim of such a program is to prevent refrigerant leaks, use the economic incentive of a deposit to ensure return of refrigerant cylinders for refrigerant recovery. The ARB is also working with the California Energy Commission to establish specifications for new commercial refrigeration systems to reduce both direct and indirect emissions of GHGs. The specifications are planned to be addressed through amendments to Title 24.

The high GWP sector is also a viable candidate for establishing an up-stream mitigation fee program (proportional to the GWP of the gases) to better promote lower GWP alternatives, lower

overall use and greater product recycling. Such an upstream fee could promote reduced emissions as well as increased end-of-life recovery. In addition, the collected fees could be used to mitigate greenhouse gas emissions. The role of an upstream mitigation fee will be investigated as part of the process for reducing emissions from the high GWP sector.

Emissions from the high GWP sector are expected to triple over the next several years translating into emissions of high GWP Kyoto gases of over 40 $MMTCO_2E$ in 2020. The collection of recommended measures is expected to yield reductions of at least 15 $MMTCO_2E$ of Kyoto gases in 2020 with the potential for further reductions as new low GWP substitutes are developed. The use of fees within this sector could likely yield higher reductions. In addition, measures will also target sources of non-Kyoto high GWP gases, with substantial reductions in 2020 (over 15 $MMTCO_2E$) expected for ODS, particularly from "banks" of materials. Although these reductions in non-Kyoto gases are not counted toward AB 32's reduction requirement, the measures that target ODS will also yield reductions of ODS substitutes.

Following the development of the rules needed to implement the measures in the high GWP sector, staff will assess whether additional measures are necessary and feasible for achieving additional reductions in high GWP GHG emissions.

Recommended Actions

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)

The primary purpose of this measure is to reduce the emissions of the high GWP gas HFC-134a, a potent greenhouse gas (GHG) with a global warming potential (GWP) of 1,300, from activities associated with do-it-yourself (DIY) charging. In the future, this measure will be expanded or a complementary measure will be developed to govern professional servicing and repair of these systems.

Under normal operation, a motor vehicle air conditioning (MVAC) system may slowly lose refrigerant due to "normal" leakage. Larger leaks are generally due to compressor leaks, and malfunctioning hoses and connections. When a vehicle's air conditioning system loses cooling effectiveness due to the loss of HFC-134a refrigerant, the vehicle owner has two choices for recharging. The system can be recharged or "topped off" using small cans of HFC-134a purchased at retail auto parts stores, or it can be serviced by a professional auto shop.

Do-it-yourselfers can save money by performing a MVAC system recharge using small cans of refrigerant instead of having a professional perform the recharge. However, the DIY rarely properly identifies the leak or performs repairs due to a lack of adequate training and/or equipment. It is also likely that DIY recharge of a MVAC system results in the release of more HFC-134a than a recharge performed by professionally trained and industry-certified technicians at a licensed auto repair facility.

The goal of this measure is to reduce or eliminate the emissions associated with nonprofessional servicing of MVACs. Under current procedures, emissions occur from servicing procedures,

unused refrigerant remaining in the used can (can heel), and unrepaired leaking systems when a DIYer recharges his MVAC.

ARB staff considered two options for addressing emissions reduction from nonprofessional servicing of MVACs. One option would restrict the sale and import of the small cans of refrigerant and allow only professional servicing of MVACs. This proposal would eliminate DIY servicing and the associated emissions. MVACs would be serviced and repaired, as needed, by trained certified technicians. Some consumers would likely forgo air conditioning in order to avoid the added cost, and some would take their vehicle to the professional shops. At full implementation, up to about 1.9 million cans would no longer be available for the DIY market. Potential emission reductions for the "small can" sales restriction would amount to approximately 0.41 $MMTCO_2E$. The "can heel" emissions would be reduced because sales of small cans of refrigerant would not be permitted. This option was included in the AB 32 Early Action Plan. However, subsequent research and analysis have led staff to the conclusion that this is not the preferred option due to the potential significant cost impact to the consumer.

The second and recommended mitigation option primarily focuses on reducing the emissions from the can heel. This proposal would require the installation of self-sealing valves on the small cans of refrigerant and enhanced consumer education, as well as an effective can deposit and return program to collect used cans of refrigerant directly from the customer for refrigerant recycling or destruction. The combination of sealed cans and refrigerant recovery would minimize the emissions from can heels. The estimated emission reductions for the self-sealing valve and recycling program are 0.26 $MMTCO_2E$ in 2020. The Board is expected to consider the recommended option for this measure at its January 2009 hearing.

Related measures aim to ensure that professional servicing of MVACs in California is less emissive than current practices. ARB staff will explore the benefit of more stringent technician certification requirements, new requirements for returnable 30 pound refrigerant containers, and other steps to improve professional servicing to gain additional emission reductions.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)

SF_6 is a versatile gas used in a multitude of industries including utilities and the semiconductor industry. These two uses will be addressed as separate measures. This Discrete Early Action measure focuses on the non-utility/semiconductor-related emissions of SF_6. Specifically, the measure will consider a potential ban on the use of SF_6 where technologically feasible and cost-effective alternatives are available, as well as a mitigation fee and/or a performance standard for other uses.

The main uses of SF_6 in California that are not directly related to utilities or semiconductor manufacturing include: magnesium casting, tracer gas use (including fume hood testing), consumer products, and medical uses (ultrasounds, eye surgery). Alternative gases are being pursued for magnesium die-casting, consumer products, and tracer gas uses. Medical use emissions appear to be very low, and are proposed to be exempt from SF_6 bans due to low emissions, high costs, and lower effectiveness of alternatives.

Based on emission estimates for 2004, emission reductions by 2020 range between 0.1 $MMTCO_2E$ and 0.3 $MMTCO_2E$.

The largest expected costs are for the magnesium sector with capital costs of $573,000 for equipment replacement for 2 facilities and a cost of $50,000 per facility for training.[124] If turnover is high, this could be an annual cost. There are two California facilities that are known to be using SF_6 and one that may be using SF_6. Depending on the alternative used, cost savings could be equivalent to $54,000 annually. The cost savings are only applicable if SO_2 is the alternative used. Other alternatives are likely to be close in cost to SF_6.

Costs for the other sectors cannot be quantified at this time. However, the capital costs and operating costs are expected to be small or may even come with a savings. Capital costs could occur if new detection equipment is needed. The cost of the alternative gas, which will be an operating cost, is likely to be the largest expense as large infrastructure changes are not needed. Alternatives are likely to be less expensive than SF_6 on a per-unit basis, but whether overall cost savings occur depends on the relative amounts of substitute gases needed.

(H-3) Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)

A specific subset of high GWP gas use is in the semiconductor industry. California semiconductor and related device production facilities employ approximately 9,300 employees, representing approximately 0.06 percent of total statewide employment. While these businesses are located throughout the State, they are concentrated in the Bay Area, primarily in the Silicon Valley.

Six local air quality agencies in the state currently regulate emissions of volatile organic compounds (VOCs) from the semiconductor and related devices industry. Federal law (National Emission Standards for Hazardous Air Pollutants) requires treatment of hazardous substances so that potential public health risks are mitigated. However, emission reductions of high GWP gases (which are not VOCs or toxic compounds) from these facilities have only occurred voluntarily through agreements with the U.S. EPA and a small number of California manufacturers.

An existing national, voluntary GHG reduction agreement with the U.S. EPA will expire in 2010. The Semiconductor Industry Association (SIA) is discussing renewing the agreement. California's proposed regulation could be used as a model for any new national regulatory or voluntary program.

The semiconductor manufacturing industry uses multiple GHGs with a range of global warming potentials from 6,500 to nearly 24,000. The sector has considerable emissions but also has potential to be an important source of GHG reductions. This proposed measure is designed to reduce the emission of these gases by 50 percent from 2006 levels.

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[124] Environment Canada. 1998. Powering GHG Reductions through Technology Advancement. Clean Technology Advancement Division, Environment Canada.
U.S. Environmental Protection Agency 2006. Global Mitigation of Non-CO_2 Greenhouse Gases. U.S.EPA Report 430-R-06-005. June 2006.

Based on the results of an industry survey conducted by ARB in 2008, the GHG emissions from more than 100 semiconductor and related devices facilities for 2006 (the latest reportable year) are approximately 0.3 $MMTCO_2E$. This is lower than the initial estimate of 0.9 $MMTCO_2E$[125] and reflects the current gas usage and control devices in-place.

The currently proposed regulation would require manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce emissions. Reductions are expected to be at least 50 percent or 0.15 $MMTCO_2E$. This measure is currently in the regulatory development process and is scheduled for adoption in 2008 with a compliance date in 2012.

Process optimization primarily focuses on reducing gas use in the chemical vapor deposition (CVD) chamber cleaning process. This practice involves the use of detectors and/or process modifications to achieve the optimum gas usage to reduce excess emissions. As part of the voluntary national program, many participating manufacturers have implemented this option at their facilities. However, many California operators do not participate in that program and will realize emissions reductions benefits from process optimization.

The use of other chemicals during the CVD cleaning or circuitry etching processes is referred to as alternative chemistries, or chemical substitution. Alternative chemistries can include the use of high GWP gases that are more efficiently used in CVD chamber cleans or plasma etching, thereby reducing overall GHG emissions. For example, some manufacturers have substituted NF_3 for C_2F_6 in CVD chamber cleans. Although NF_3 has a higher GWP than C_2F_6 (17,000 for the former, 9,200 for the latter), much less NF_3 is used in the process so that overall emissions are reduced. It is important to note here that the proper use and control of NF_3 is accounted for in the emission reduction potential for this rule, it is not accounted for in ARB's GHG inventory because NF_3 is a non-Kyoto GHG.

Abatement technologies commonly involve a device that thermally destroys fluorinated gases and can be commercially applied to both etch and CVD chamber clean processes. High temperature and catalytic oxidation and plasma destruction are the most common technologies used to abate emissions. The performance of abatement systems can vary greatly depending on the abatement device and process parameters, such as temperature and gas flow rates. Nonetheless, abatement has proven to be a commercially available and effective method of controlling emissions of GHGs.

These devices can be costly and use large amounts of energy and cooling. If semiconductor manufacturers in California choose abatement as a compliance option, ARB believes that up to 24 systems may be installed Statewide. These systems would not significantly impact sector energy demand. While this technology results in some additional energy use, the destruction of these high GWP gases provides a net benefit in reducing GHGs.

[125] Based on applying a growth factor of 1.35 percent per year to ARB's 2004 inventory estimates

(H-4) Limit High GWP Use in Consumer Products (Discrete Early Action)

Consumer products containing high GWP GHGs include pressurized containers that utilize HFC propellants,[126] as well as other miscellaneous products such as boat horns, dusters, and tire inflators.[127]

The objective of this measure is to reduce the use of compounds with high GWP when alternatives are available. To achieve reductions of GHG emissions, consumer product formulations would need to be changed to reduce or eliminate the use of high GWP compounds. The reduction in use of compounds with high GWP in consumer products is a long-term effort.

This measure was designated as a Discrete Early Action, and a regulation establishing a GWP limit of 150 for Pressurized Gas Dusters was adopted by ARB in June 2008 and will be enforceable by January 2010. Staff will propose GWP limits for additional consumer product categories, where feasible, which would also be enforceable by the deadline for discrete early action items.

Total GHG emissions reduction from consumer products is estimated to be 0.25 $MMTCO_2E$ in 2020. ARB staff estimates emissions reduction of 0.23 $MMTCO_2E$ from the regulation of Pressurized Gas Dusters.

In the case of Pressurized Gas Dusters, manufacturers of non-complying products are expected to reformulate their products by switching from the use of HFC-134a (GWP of 1,300) to HFC-152a (GWP of 140). 18 of 90 products in the Pressurized Gas Duster category currently comply with the GWP limit of 150, representing a market share of 86 percent, based on sales. HFC-152a is less expensive per pound than HFC-134a, so it is anticipated that there would be a raw ingredient cost savings in virtually every case. The total cost of the measure to reduce GHG from Pressurized Gas Duster products is about $450,000 over ten years, or $45,000 per year.

(H-5) High GWP Reductions from Mobile Sources

Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems

The measure requires low global warming potential (GWP) refrigerants with overall improved lifecycle climate performance for new Motor Vehicle Air Conditioning (MVAC) systems, with initial emphasis on A/C systems used for heavy-duty and off-road vehicle application, followed by a MVAC requirement in light-duty vehicles.

Currently, almost all new passenger vehicles sold in California come equipped with an air conditioning system that utilizes HFC-134a refrigerant, which has a GWP of 1,300. A/C systems typically leak refrigerant over time and their leakage rates increase with vehicle age. In addition, the use of the A/C system requires energy from the vehicle's engine. On an annual basis, this accounts for up to 5 percent of the total vehicle fuel usage. Fuel consumption while

[126] Hair sprays, deodorants, household products, spray paints may contain HFCs propellants, but are considered to be minor sources. Metered dose inhalers also contain HFCs, but due to medical necessity, low-GWP replacements are not currently being pursued in the Early Action Measures or Scoping Plan.

[127] Automotive products such as cans of refrigerant used for do-it-yourself (DIY) MVAC recharging, are covered within the mobile sources sub-sector rather than the consumer products sub-sector.

the A/C is on can increase by over 20 percent. Thus, it is desirable to have lower amounts of refrigerant and/or low GWP refrigerants in tighter A/C systems with improved efficiency. New HFC alternative refrigerants with lower GWP values are expected to become available substitutes for HFC-134a in new MVACs.

The core of the measure would focus on developing new regulations requiring (1) that new MVACs use refrigerants with GWP below a specified threshold (to be determined) in new vehicles not subject to California's adopted vehicle GHG emission standards (AB 1493) and (2) improvements in MVACs system performance for reduced indirect emissions. For vehicles subject to AB 1493, this measure would explore further MVAC improvements when the first phase of the rule is fully implemented. This measure would apply to all MVACs in vehicles certified for sale in California after 2016, impacting about 7 million light-duty vehicles and about 2 million medium and heavy-duty vehicles by the year 2020.

The central premise of the proposed measure is the replacement of high GWP refrigerants used in California's MVACs with lower GWP alternatives that also represent better lifecycle climate performance (LCCP) than the current refrigerant. Indirect emissions from fuel use can be three times the direct emissions from a typical MVAC. Thus, the rules would be designed to promote a shift towards better overall MVAC performance. With low GWP refrigerants there is a corresponding reduction of the impact from MVAC servicing and releases at the vehicle/equipment end of life.

Direct and indirect emissions from air conditioning systems in California's on-road light-duty vehicles (LDVs) are already governed by the regulations resulting from AB 1493 through the 2016 new model year. Accordingly, manufacturers can use low GWP alternative refrigerants as one tool for complying with ARB limits on GHG emissions for the entire vehicle or for generating early compliance emission credits. Air conditioning systems in all other on-road classes and all off-road vehicles are presently unregulated by California. This measure would cover those classes of vehicles not included in the AB 1493 regulation.

Development of this measure will benefit from consideration of a similar regulation calling for the phase out of HFC-134a beginning with new types of vehicles in 2011 adopted recently by the European Union. Staff will explore the potential GHG reductions from a similar phase out of HFC-134a (or other high GWP refrigerants) used in other vehicle classes in the California fleet such as heavy-duty on- and off-road vehicles including new as well as in-use systems. The identification of suitable alternatives would be based on lifecycle climate performance. In all cases, careful attention will be paid to ensure the indirect emissions are also lowered via the deployment of more energy efficient systems.

Anticipated reductions for 2020 are expected to be 0.7 $MMTCO_2E$ for light-duty vehicles and 1.8 $MMTCO_2E$ for heavy-duty vehicles for a total of 2.5 $MMTCO_2E$ for a universal phase out of HFC-134a in new and in-use MVACs in California.

Air Conditioner Refrigerant Leak Test During Vehicle Smog Check

There are 11 million Smog Checks performed annually as part of California's vehicular inspection and maintenance (I/M) program. As originally proposed, the measure would add a refrigerant leak check to the "pass" criteria for California Smog Checks.

The goal of this measure is to reduce the number of in-use MVACs that are leaking excessively. The reduction would be calculated based on the number of vehicles failing the MVACs Smog Check and subsequently repaired. This measure would prevent the ongoing "leak-recharge-leak" cycle associated with the use of small cans of refrigerant by do-it-yourselfers to systems that need repair but are not fixed.

In order for this measure to be implemented, ARB would work with the Bureau of Automotive Repair (BAR) and the Department of Consumer Affairs (DCA) to develop a new A/C test protocol and incorporate it into Smog Check procedures. The vehicle owner would see a slight increase in the duration and cost of the Smog Check biannual inspection.

The potential emission reductions from this measure are up to about 0.5 $MMTCO_2E$ per year by 2020. Due to the increased time and equipment required for the MVAC system test, the consumer price of a Smog Check is estimated to increase by about $20 per check. However, staff's assessment of this measure has continued to evolve. Given that new MVACs are tighter and require less refrigerant, the relative importance of the measure will continue to decline as it is generally limited to older vehicles. Further, there may be more efficient approaches outside of Smog Check that can facilitate the identification and repair of leaky MVACs. Staff is exploring alternative approaches for mitigating emissions independent of the Smog Check program.

Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers

As noted by the Environmental Justice Advisory Committee, refrigerated shipping containers accumulate in major ports and the refrigeration systems on these containers may leak high GWP refrigerants. ARB proposes a measure to address the refrigerant remaining in the decommissioned containers' cooling systems, the leakage from these containers, and their disposal as they approach their end-of-life (EOL). Upon reaching EOL, these types of containers may not undergo proper refrigerant recovery.

This measure would improve compliance with a Federal Clean Air Act regulation by the U.S. EPA (40 CFR 82) that prohibits venting of certain types of refrigerant, including HFCs, to the atmosphere when refrigeration equipment is serviced or dismantled. Thus, the intent of this measure is to mitigate any impacts from releases, either intended or accidental, of refrigerant from refrigerated shipping containers. Venting is avoided by recovering refrigerants with specialized equipment. The recovered refrigerant can be re-used by the owner or transferred to re-processors approved by U.S. EPA.

Since there are no firm statistics related to the degree of compliance with the requirements of 40 CFR 82, no quantitative estimate of emission reductions can be proposed yet. The ultimate goal will be to recover the refrigerant remaining in the refrigerated shipping containers at decommissioning and eliminate the greenhouse gas emissions from this source.

Implementation of this measure may be similar to the one enforcing the federal ban on releasing refrigerants to the atmosphere for the servicing or dismantling of Motor Vehicle Air Conditioning (MVAC) systems. After the recovery of refrigerant from a decommissioned container, it may be desirable to disable the refrigeration unit as well, which could require a regulation. The anticipated approach would emphasize enhanced enforcement of existing federal requirements for recovery via audits of activities and documentation. Including oversight,

inspection, recordkeeping, and/or reporting requirements in the implementation of this measure may require additional regulations.

The primary reason for implementing the recovery of refrigerant from decommissioned refrigerated shipping containers is to reduce greenhouse gas emissions. However, any destruction of ozone-depleting substances that were used in older refrigeration systems will also prevent the negative impacts on stratospheric ozone that would have resulted from the ODS emissions. Staff will develop estimated emission reductions as well as mitigation costs to determine the degree to which the measure represents a viable emission reduction option.

Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems

The goal of this measure is improved compliance with existing regulations[128] prohibiting the venting of certain types of refrigerant, including HFCs, to the atmosphere when motor vehicle air conditioning (MVAC) equipment is serviced or dismantled. Venting is avoided by recovering refrigerants with specialized equipment before dismantling or servicing. The recovered refrigerant can be re-used or transferred to re-processors approved by U.S. EPA for proper disposal.

ARB, U.S. EPA, the California Department of Motor Vehicles (DMV), and the Bureau of Automotive Repair (BAR) will be involved in the implementation of this measure.

Much of the field work in a cooperative enforcement program could involve the enforcement staff of the local agencies that enforce county and State ordinances regarding disposition of automotive fluids, such as brake fluid, engine oil, coolant, and transmission fluid. These agencies could receive a “leveraging” effect for their programs if ARB and US EPA resources are made available in a cooperative program for enforcing the federal refrigerant-recovery regulation.

The potential reductions from dismantling are on the order of 0.07 to 0.3 $MMTCO_2E$ per year in 2020. Further, it is anticipated that a collaborative arrangement with U.S. EPA has the potential to yield reductions with a modest resource commitment by either entity.

There are no added costs associated with the proposed measure beyond those currently imposed. Any incurred expenses are costs that the dismantler or technician has avoided so far by failure to comply with the existing federal regulation.

(H-6) High GWP Reductions from Stationary Sources

High GWP Stationary Equipment Refrigerant Management Program

ARB staff has proposed to create the high-GWP Stationary Equipment Refrigerant Management Program, which integrates two AB 32 early action measures: High GWP Refrigerant Tracking, Reporting, Repair and Deposit for Stationary Refrigeration and Air Conditioning systems and Specifications for New Commercial and Industrial Refrigeration Systems. These two measures, discussed below, target different areas of the refrigerant value chain for stationary equipment.

[128] Existing federal regulation (40 CFR 82.154) bans the release to the atmosphere of high GWP refrigerants at the end-of-life (EOL) or during equipment servicing.

The Stationary Equipment Refrigerant Management Program approaches the challenge of high GWP gases management in a more systematic manner integrating all sectors of the value chain.

Refrigerant Tracking/Reporting/Repair/Deposit Program

This measure would require commercial and public facilities with large stationary air conditioning and refrigeration equipment to minimize emissions of high GWP refrigerants through reporting, leak repair, improved servicing, and end-of-life control.

This program could include several components: 1) leak repair, monitoring, reporting, technician certification, and registration/permitting requirements for refrigeration and air conditioning equipment using high GWP refrigerants; and 2) a deposit program accompanied by restrictions on cylinders and other containers used to store and transport high GWP gases.

The South Coast Air Quality Management District currently requires facilities with refrigeration and/or air conditioning systems containing more than 50 pounds of ozone depleting substances to submit annual reporting of refrigerant usage biennially. The program also requires that facilities repair leaks. ARB staff has extrapolated reported data from SCAQMD to estimate potential statewide reductions. Based on this extrapolation, it is expected that roughly 86,000 facilities in California could be affected by ARB's program; of the 86,000, staff estimate that 10,000 facilities have both air conditioning and refrigeration systems while 76,000 facilities have only air conditioning systems.

Preliminary estimates are that in 2020, emission reductions could total 7.7 $MMTCO_2E$ of ozone depleting substances (ODS) and 6.3 $MMTCO_2E$ of HFC refrigerants. The reductions would occur as a result of improved leak detection and repair, along with installation of new equipment, and ODS phase out.

Estimates for monitoring costs are $2,500 per facility for equipment and $100 in annual operating costs. Repair of air conditioning systems is roughly $2,500 ($2,000 in labor costs and $500 in parts and refrigerant), while system replacement would cost on the order of $20,000. For refrigeration, repair is estimated to cost $11,000 ($3,000 in labor costs and $8,000 in parts and refrigerant), while system replacement would cost on the order of $500,000. Statewide costs are estimated at about $9 million in 2020. Preliminary analysis reveals that the measure is expected to result in a savings in 2020 on the order of $75 million due to the reduced consumption of refrigerant. Additional analyses are underway on potential costs associated with safe disposal of equipment and refrigerant (e.g., a cylinder deposit program) and to refine these preliminary estimates.

Specifications for Commercial and Industrial Refrigeration

This measure proposes new specifications for commercial and industrial refrigeration systems to both reduce emissions of high GWP refrigerant and to increase energy efficiency of the units. The measure would apply to a portion of commercial and industrial refrigeration systems, including large direct expansion (DX) refrigeration systems used in supermarkets, cold storage warehouses, and industrial processes, including food processing. Commercial refrigeration systems also include retail food standalone equipment (open and closed food display cases) and refrigerated vending machines.

Emissions from refrigeration and air conditioning (RAC) systems are categorized as (1) direct refrigerant emissions via leaks during use as well as servicing and end-of-life emissions and (2) indirect emissions (CO_2-equivalent emissions resulting from energy use).

Because the piping required for connection of all the cases can be miles long, DX systems may contain very large refrigerant charges, typically several thousand pounds; they are also leaky, with average leak rates in California estimated to be 20 – 30 percent of refrigerant charge annually. Leaks result from vibration and thermal expansion of numerous pipes, threaded joints, fittings, and valves. Oftentimes, refrigerant pipe work is inaccessible, and leaks cannot be found or repaired. Ruptures can result in huge refrigerant losses, with GHG emissions exceeding several thousand metric tons carbon dioxide equivalent.

In terms of potential control strategies, reduction of leaks and charge sizes in direct expansion systems is of primary importance. Reduction of charge size not only reduces the potential for high GWP emissions from system ruptures, but reduces future high GWP refrigerant banks in California. Refrigerant banks are sources of future emissions, and without a recovery/destruction program in place, will eventually be emitted during equipment charging, lifetime, and end-of-life (EOL).

The regulation is expected to establish performance limits for new systems. Options for reducing leaks, charge sizes, and refrigerant GWPs include replacement of DX systems with indirect systems, i.e. secondary loop (SL) systems, and energy efficiency improvements through closed cases, floating head pressure controls, and best available display case components, standalone equipment and vending machines. This performance-based measure is expected to address direct and indirect emissions reductions during the lifetimes of commercial and industrial refrigeration systems.

For new commercial and industrial refrigeration systems, this measure would establish a low leak rate (e.g., 2 percent) as well as a possible limit on the product of charge size and refrigerant GWP less than a specified threshold. Secondary loop systems and advanced CO_2 systems are both being explored as potential options for reducing emissions from new commercial and industrial refrigeration applications.

In addition, ARB has initiated discussions with the California Energy Commission (CEC) and other stakeholders to explore integrating specifications into the next version of California Buildings Standards Code (Title 24) that would reduce direct refrigerant emissions from new commercial and industrial refrigeration systems and establish energy efficiency goals for new and existing retail food systems. The CEC supports this approach and has committed to work with ARB. The next version of Title 24 will be released in the 2011 timeframe and therefore the compliance with these performance standards for new large commercial/industrial refrigeration installations would be expected to start by 2012.

As the old DX systems turnover, high GWP GHGs will need recovery, reclamation, and destruction or reuse. Refrigerant recovery and destruction is being addressed as part of other strategies in the high GWP sector.

In total, direct and indirect GHG emission reduction potential from this measure in 2020 is estimated to be at least 4 $MMTCO_2E$. Additional benefits of this measure include stratospheric

ozone protection for the estimated 50 percent of DX systems that currently employ HCFC-22, an ozone-depleting GHG.

Currently, first installation costs for SL systems are higher than existing DX systems, with average costs estimated to be 15-20 percent greater, or around $100,000[129,130]. The incremental costs associated with incorporating energy efficient equipment into new retail food installations is expected to be small relative to overall refrigeration system construction costs. Based on an estimated value of 40 percent lower maintenance and repair costs relative to the annual DX maintenance and repair cost in California (~$64,000[131]), the annual operations cost savings is on the order of $25,000, though considerably more work needs to take better to evaluate the net costs of the various options.

Average capital costs for supermarket refrigerant systems are on the order of $1.7 million, with systems having a 20-year lifetime. Due to increased energy efficiency, the operations savings from reduced electricity use are estimated at $700,000 annually.

The capital costs of upgrading existing systems or installing new systems are expected to be passed along to customers, so in the case of retail food stores and food processors, increased food and beverage costs are possible and will need to be evaluated.

Foam Recovery and Destruction Program

Waste insulation foam emits high GWP GHGs into the atmosphere when it is shredded during appliance recycling or broken during building construction, renovation, and demolition. The waste foam continues to emit GHGs while it is landfilled.[132] The goal of the measure is to reduce these emissions to as close to zero as possible, by diverting waste foam away from landfills, and destroying the foam at high temperatures; or by capturing the high GWP GHGs within the foam for destruction or reuse.

Plastic insulating foams containing high GWP blowing agents are used in refrigerators, freezers, building insulation, transport refrigerated units, and miscellaneous sources. For insulating foam containing high GWP GHGs, the vast majority are used in building insulation (65 percent of banks and emissions) and appliances (mainly refrigerators and freezers, about 30 percent). After the appliance or insulating material has reached the end of its life, the waste foam is often landfilled, and the high GWP gases within the foam are eventually emitted into the atmosphere.[133] Typically, about one-fourth of the GHGs remaining in foams during their disposal are released to the atmosphere as the foam is processed (e.g., broken or shredded). Of the GHGs that remain within foams that are landfilled about 60 percent are captured and

[129] Van D. Baxter, Oak Ridge National Laboratory, IEA Annex 26: Advanced Supermarket Refrigeration/Heat Recovery Systems, Final Report Volume 1 – Executive Summary, April 2003.
[130] Cynthia Gage (USEPA) ASHRAE presentation: "Experiences with Secondary Systems", 2/05.
[131] Maintenance and repair costs for supermarkets are on the order of $2.35/square foot for California, which, multiplied by the average square footage, 27,000 square feet (from ARMINES), gives $63,450 annually: http://www.whitestoneresearch.com/news/archive/1998/980828.htm
[132] USEPA, U.S. High GWP Emissions 1990-2010: Inventories, Projections and Opportunities for Reductions, EPA 000-F-97-000, June 2001
[133] IPCC/TEAP, IPCC Special Report on Safeguarding the Ozone Layer and the Global Climate System, Issues related to Hydrofluorocarbons and Perfluorocarbons, 2005.

combusted by landfill gas collection systems with the balance eventually being released to the atmosphere.

The program can be implemented using measures that provide regulatory standards or incentives for the recovery and collection of foam. Either approach would necessitate restricting waste foam from landfills or recovering high GWP gases at the point of appliance recycling or building demolition, deconstruction, or renovation prior to landfilling the foam.

This measure will primarily target appliance foam with possible additional emissions reductions from recovery of building foam. If 100 percent of waste foam were diverted from landfills and sent to recovery and destruction facilities by 2020, 6,000 metric tons of waste foam containing HFCs would be recovered in 2020. At this level, annual HFC emissions reduction would be about 0.3 $MMTCO_2E$ from appliance foam, with another 0.7 $MMTCO_2E$ that could be reduced from building insulation foam, for a total of 1.0 $MMTCO_2E$. ODS recovery and destruction will occur simultaneously with HFC reduction, equivalent to an additional 5.5 $MMTCO_2E$ in 2020.[134]

Costs to recover and destroy foam from appliances are about \$30/$MTCO_2E$ using an automated system. The annual cost of an appliance foam recovery and destruction program to reduce 0.3 $MMTCO_2E$ would be about \$9 million per year, assuming all appliances were recycled using an automated system.

Beyond the scope of the proposed measure, building insulation foam can also be recovered, at an estimated cost of \$182/$MTCO_2E$. Reduction of 0.7 $MMTCO_2E$ from building foam would cost \$127 million per year.

Costs of the different segment of a foam recovery and destruction program can also be expressed in practical units as follows: [135]

- \$13.50 per appliance using an automated recycling system
- \$40 per appliance using manual foam recovery
- \$6 - \$17/square foot of building area (depending upon type of building, single-story versus multiple stories) for building insulation foam recovery [136]

SF_6 Leak Reduction and Recycling in Electrical Applications

Gas-insulated circuit breakers that use SF_6 as an insulating gas are the largest source of fugitive SF_6 emissions in California electricity systems. In addition, gas-insulated substations (GIS) constitute a smaller source of SF_6 emissions. In general, older equipment produces more fugitive emissions than newer equipment. Moreover, particle accelerators utilize and emit SF_6 from equipment similar to that found in electrical transmission and distribution equipment. Particle accelerators also use SF_6 as a quenching medium.

This measure will reduce emissions of SF_6 within the electric utility sector and at particle accelerators by requiring the use of best achievable control technology for the detection and

[134] U.S. EPA, Vintaging Model for ODS and High-GWP GHG Emissions, 2006.
[135] "US EPA. Global Mitigation of Non-CO_2 Greenhouse Gases, EPA 430-R-06-005, June 2006"
[136] Caleb Management Services. Foam Recovery and Destruction Cost Estimates from Pilot Programs in Europe and Japan, 2007. Policy Advisory for IPCC Foam Emissions Research. Forwarded to ARB May 21, 2008.

repair of leaks, and the recycling of SF_6. Particle accelerator industry representatives are already considering the use of possible substitute mediums.

SF_6 is primarily released when equipment is opened for routine servicing. Sometimes, SF_6 is vented to the atmosphere during servicing, but increased environmental awareness and large increases in the cost of SF_6 during the mid-1990's have significantly reduced this practice.

The estimated emissions annual reduction of 0.07 $MMTCO_2E$ is based on the projected 2020 emissions of 0.22 $MMTCO_2E$ multiplied by the U.S. EPA reduction estimate of 20 percent for leak detection and repair and ten percent for recycling and recovery.

This measure would establish a regulation mandating a performance standard. Utilities and other affected entities would comply by using leak detection and repair (LDAR) abatement equipment to reduce system leakage. The proposed performance standard would mandate and enhance current voluntary federal SF_6 recycling standards. Voluntary industry practices have established an 80 percent SF_6 recovery rate, based on perceived economic efficiencies of recovery equipment. The proposed standard would increase recovery and recycling to 100 percent of the SF_6 contained in electrical and particle accelerator equipment without substantially increasing the industries' costs.

Statewide annual operating costs are estimated to be $300,000 for LDAR and recycling. However, it is assumed that all SF_6 saved during leak detection and maintenance activities represents a cost savings, because the facility SF_6 purchase and consumption rate will decrease. The cost savings from SF_6 is $420,000 annually, yielding a net cost savings of $120,000.

Alternative Suppressants in Fire Protection Systems

This measure will consider alternative suppressants in total flooding (fixed) and streaming (portable) fire suppression systems. Most fire suppression systems originally used halons, ozone depleting compounds whose production was phased out following the Montreal Protocol, but new systems have moved to halon alternatives. ARB is coordinating its evaluation of potential mitigation measures with several stakeholders including the Office of the State Fire Marshal.

Over 16 percent of total flooding systems have moved to high GWP suppressants.[137] In comparison, streaming systems have moved almost exclusively to non-GWP agents, but there are some high GWP suppressants on the market. This measure will concentrate on total flooding systems but will also determine if there are reduction options for the streaming market.

The emissions of high GWP gases from fire protection systems come from intentional use as a fire suppressant, leakage, and accidental discharges. In total, annual emissions are estimated at 1.5-2 percent of total banks. The U.S. Environmental Protection Agency has developed voluntary guidelines to minimize non-fire emissions of HFCs and PFCs, and the fire protection industry has implemented a data collection effort to better understand emissions.

In addition to emissions, the continued use of high GWP agents in new systems will result in a build-up (or bank) of high GWP gases in fire suppression systems. Banks of high GWP gases are of concern because these gases will eventually be emitted, unless they are collected and

[137] U.S. EPA. Global Mitigation of Non-CO_2 Greenhouse Gases. U.S. EPA Report 430-R-06-005. June 2006.

destroyed or recycled. Leak reduction can minimize current emissions and recycling can reduce the bank growth.

The goal of this measure is two-fold: to reduce emissions and banks of high GWP gases from the fire protection sector, and to ensure low end-of-life emissions from halon systems. For high GWP systems, this measure will consider options for existing and new systems for both total flooding and portable applications. Leak reduction, mitigation fees, use of lower GWP agents, and end-of-life agent recycling and destruction are potential options to be examined. Most halon systems will reach their end of life by 2020, so a goal of this measure is to have all halon systems that are decommissioned either recycle or destroy the halon.

As noted above, this measure will have an effect on both emissions and banks. Emissions should be reduced to less that 0.1 $MMTCO_2E$ with an effort to ensure limited growth in high GWP banks between 2012 and 2020. Business-as-usual projections show a doubling of emissions in that time period. Depending on the availability of alternatives it may be possible to prevent growth in the banks altogether. Annual emissions reduction is estimated to be less than 0.1 $MMTCO_2E$ in 2020.

Cost estimates are uncertain at this time given the lack of data on the number and size of systems in California. Assuming installation of low or non-GWP suppressants in systems coming online between 2010 and 2015, statewide one-time costs vary from $10 million to $12 million for 2012-2015 with annual costs ranging from $200,000 to a savings of $200,000, depending on the substitute gas. For systems coming online between 2015 and 2020 the statewide one-time cost is approximately $3 to 4 million with annual costs ranging from $70,000 to a savings of a similar amount.[138] These estimates assume a 20-year equipment lifetime. The resulting costs may seem high per metric ton of CO_2E emitted because the capital costs occur upon installation of the system, but emissions occur slowly (2 percent per year) over 20 years or longer. Costs only account for emissions and not the increasing banks of high GWP agents. Staff is in the very preliminary stages of assessing both the emission reduction potential as well as the costs for this category. As such, the viability of the measure will continue to be assessed as the analysis proceeds.

Residential Refrigeration Early Retirement Program

This non-regulatory measure involves partnering with existing voluntary programs to retire inefficient residential refrigeration appliances such as refrigerators and freezers. Appliance early retirement includes the recovery of high-GWP refrigerants and blowing agents for reclamation or destruction to avoid GHG emissions. If all waste refrigerant and foam blowing agents are properly reclaimed or destroyed GHG emissions avoidance benefits may be significant. Staff believes that by partnering with organizations such as utilities ARB can increase the role of appliance early retirement programs as an option for reducing GHG emissions. Part of the measure would include providing information to assist with the proper disposal of appliances including the insulating foams that include high-GWP substances as blowing agents.

Based on California law, all appliances are required to be recycled and the refrigerant recovered, but there is no requirement to recover foam blowing agents. A primary benefit of this measure would be the recovery and destruction of foam blowing agents from retired appliances.

[138] Ibid.

Residential appliances targeted for early retirement will begin with pre-1996 refrigerators using refrigerants and foam blowing agents that total about five metric tons carbon dioxide equivalent per appliance. The goal of this measure is to increase early retirement rates of inefficient residential appliances.

This measure will be coordinated with the Foam Recovery/Destruction measure, another early action measure that is expected to require EOL recovery of high-GWP refrigerants and foam blowing agents from appliances. The Residential Refrigeration program will focus on operating refrigerators, while the Foam Recovery/Destruction measure will focus on non-operating refrigerators.

Current tools to encourage early retirement of appliances consist of the U.S. EPA Responsible Appliance Disposal program, a promotional program to support retailers and utilities using best practices in appliance disposal, and utility companies' energy efficiency programs. The primary solution considered under this measure is to support these programs. This support may be provided directly through ARB's existing outreach efforts or potentially through development of mechanisms to increase incentives provided to consumers, businesses, and/or appliance recyclers.

In 2020, there are potential one-year direct GHG emission reductions of 0.1 $MMTCO_2E$, which are primarily from Kyoto gases. Additionally, there are potential one-year indirect GHG emission reductions resulting from energy savings, which are a result of retirement of inefficient residential refrigeration appliances.

(H-7) Mitigation Fee on High GWP Gases

This measure would establish an upstream mitigation fee on sales of high GWP industrial gases. These gases have potent global warming potentials and an upstream fee would ensure that the climate impact of these substances is incorporated into their price, encouraging emission reductions and the development of alternatives. Even with the reductions from other high GWP measures, the sector's emissions would still be over 30 $MMTCO_2E$ in 2020 (and about twice current emissions). This difficulty in reducing absolute emissions is because the high GWP sector is the fastest-growing category in California's GHG inventory due, in part, to the replacement of ODS for which production is being phased-out. The remaining emissions would be difficult to address via traditional regulatory approaches since the gases are used in many small uses in diverse applications and there is potential for new or evolving uses. Additionally, some uses have no current alternative and there is a lack of incentive to either develop alternatives or reduce leakage. The mitigation fee would complement rather than replace many of the downstream high GWP regulations currently being developed. As sources comply with the regulatory measures, affected entities would reduce their emissions and therefore the amount of the fee they would need to pay. The fee would address high GWP gases in a consistent manner, on a carbon dioxide equivalent basis, and serve to change behavior, induce new lower GWP alternative products, and provide revenue that can be used to mitigate GHG emissions elsewhere. Addressing this large source of emissions will provide reductions in 2020 and will also position California for further reductions beyond 2020.

A stakeholder process to evaluate and potentially develop a fee on sales of gases with high-GWPs will begin in early 2009. Emission reductions from the mitigation fee would be a

function of the fee level as well as how revenues are directed. The level of the fee would be set based on economic and technical evaluations. Fees would be administered by the ARB, and would be assessed at a consistent rate per $MTCO_2E$. Depending upon the fee level, the annual revenue generated may range from $300 million to over $1 billion. However, the recommended fee, as well as the structure of the program, would be developed through a stakeholder process before consideration by the Board.

The revenue generated through the mitigation fees could be used to achieve cost-effective reductions of GHGs. Possible uses include greenhouse gas mitigation, investment in efficiency, research and development and deployment of green technologies. It is anticipated that reductions in banks of ODS could also be considered as an option for use of the fee revenue. However, determining the appropriate use and expending any revenues would likely require legislative or budget act authority.

The reductions, fee levels, and structure are preliminary and further analysis and stakeholder input will be necessary. The mitigation fee measure is expected to go to the Board in late 2009/early 2010.

Appendix C: High GWP
Table 32

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
H-1: Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)	0.26	3	ARB	2009/2010
H-2: SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3	0.08	ARB	2009/2010
H-3: Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)	0.15	2.6	ARB	2008/2012
H-4: Limit High GWP Use in Consumer Products (Discrete Early Action)		0.06		
Pressurized Gas Duster GWP Limit of 150	0.23		ARB	2008/2012+
Other Consumer Product Categories	0.02		ARB	Ongoing
H-5: High GWP Reductions from Mobile Sources		20.86		
Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems	2.5		ARB	2010/2015
Air Conditioner Refrigerant Leak Test During Vehicle Smog Check	0.5		ARB/ BAR	2011/2012*
Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers	0.2		ARB	2011/2012

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	0.1		ARB	2009/2010*
H-6: High GWP Reductions from Stationary Sources		See Separate Entry Below		
Stationary Equipment Refrigerant Management Program- Refrigerant Tracking/Reporting/ Repair/Deposit Program	6.3	-2.58	ARB	2009/2010
Stationary Equipment Refrigerant Management Program- Specifications for Commercial and Industrial Refrigeration	4.0	0.58	ARB/CEC	2011/2012
Foam Recovery and Destruction Program	0.3	9	ARB	2009/2010
SF_6 Leak Reduction and Recycling in Electrical Applications	0.1	0	ARB	2010/2012
Alternative Suppressants in Fire Protection Systems	0.1	1.76	ARB/ Cal/Fire	2010/2011*
Residential Refrigeration Early Retirement Program	0.1	-5.89	ARB	2010/2011*
H-7: Mitigation Fee on High GWP Gases	5[139]	100	ARB	2009/2010

*Informational items as they are non-regulatory or the regulations would be adopted by another organization (e.g., fire suppression strategy is expected to be adopted by Cal/Fire via amendments to Title 24).
†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

[139] The 5 $MMTCO_2E$ reduction is an estimate of what might occur with a fee in place. Additional emission reductions from a fee would be expected as resulting revenues are used in mitigation programs. Using the funds to mitigate greenhouse gas emissions could substantially increase the emission reductions from this measure.

12. AGRICULTURE

This sector includes the following measures:

<u>Recommended Actions</u>
(A-1) Methane Capture at Large Dairies

<u>Areas of Research/Opportunities for future GHG Emission Reductions</u>
Assessing and Reducing N2O Emissions
Efficiency Improvements

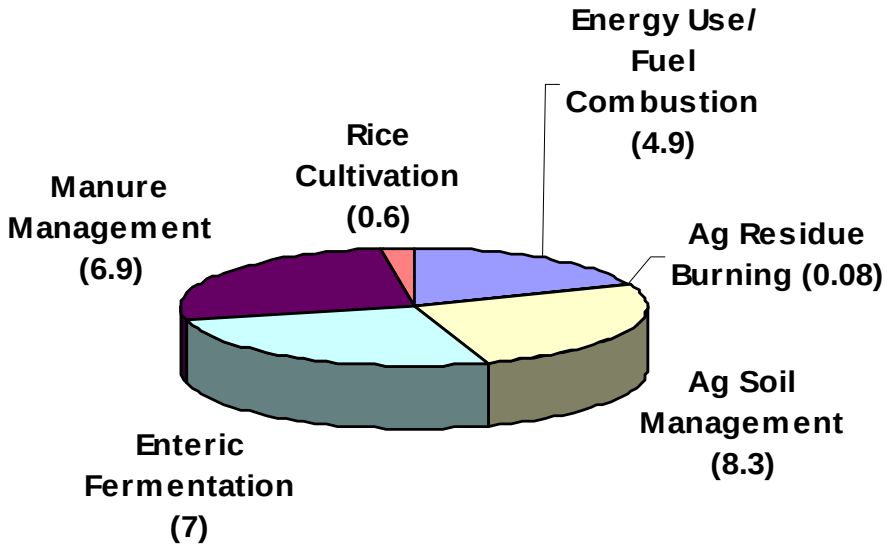
ARB worked closely within the CAT and its sector-specific subgroups, the Economic and Technology Advancement Advisory Committee, and with stakeholders to develop the measures included in this Plan. This input was evaluated and analyzed by ARB and is reflected in the measures included in this sector.

Overview

For purposes of California's GHG inventory and AB 32 implementation, the Agricultural sector includes on-farm emissions from animals and from crop cultivation and management, but does not include post-farm processing and distribution or manufacture of inputs such as pesticides or fertilizer. On-farm sources include emissions from animal wastes, energy use (including fuel combustion), crop residue burning, enteric fermentation, soil management practices (such as fertilizer and manure applications and soil liming), and anaerobic decomposition of organic matter.

Appendix C: Agriculture Figure 8

2004 Agriculture Sector Emissions ($MMTCO_2E$)



In 1990, the Agricultural sector emitted an estimated 23.4 $MMTCO_2E$, representing five percent of the statewide total. This figure increased to 27.9 $MMTCO_2E$ in 2004, or six percent of the statewide total. The emissions forecast for the sector shows an increase in emissions to

29.8 $MMTCO_2E$ in 2020; the primary driver behind the projected increase is growth in dairy livestock.

The Agricultural sector presents several opportunities to reduce GHG emissions and help California achieve the reductions necessary to meet the goals of AB 32. GHG reduction strategies for the Agricultural sector include voluntary actions to reduce emissions and research to better quantify emissions and identify further opportunities for reductions. Many of the voluntary strategies presented for the Agricultural sector were identified by the Economic and Technology Advancement Advisory Committee.

As described below, the Scoping Plan includes a recommended voluntary measure for methane capture at dairies though use of manure digester systems. This voluntary approach is designed to encourage investment in technology and improve cost-effectiveness over time. The voluntary approach will be re-assessed at the five-year Scoping Plan update to determine if the program should be made mandatory for large dairies by 2020. This reassessment will include performance, cost-effectiveness, and other actions needed to facilitate implementation, but specific criteria for the evaluation are not yet developed.

The Plan includes a two-phase research effort to better understand N_2O emissions from fertilizer applications. Phase 1 of this effort will address the variables affecting emissions and, based on the findings in Phase 1, Phase 2 will explore opportunities for emission reductions. Also included are potential voluntary measures such as improved water efficiency, improved irrigation pump efficiency, and optimal tire inflation (for fuel savings). These potential strategies may not be appropriate in every situation but provide an opportunity for greenhouse gas reductions and cost savings through reduced fuel use.

In addition to the strategies in the Scoping Plan, there are other opportunities for the Agricultural sector to reduce GHG emissions. One of these areas is the utilization of agricultural biomass for electricity generation and fuel production. Approximately 8 million tons of agricultural biomass is available for use annually; however, only 1.1 million tons is currently utilized largely due to technological impediments. Traditionally, this biomass has been burned on-site, incorporated into the soil, chipped, or sent to a landfill. More productive use of this material will reduce GHG emissions related to its disposal or decomposition, and serve as a renewable energy source displacing demand for fossil fuel use. Utilization of this material would complement regulatory programs requiring farmers to reduce open burning of residues by providing a disposal avenue for biomass that would have otherwise been burned, subjected to anaerobic decomposition, or disposed of in landfills. Development of bioenergy sources, which supports California's renewable energy goals, will be tracked and accounted for in the Energy sector.

Increasing carbon sequestration in plants or soils offers another potential opportunity for the Agricultural sector. Under certain conditions, practices such as conservation tillage, cover cropping, and incorporating soil amendments may increase or retain soil carbon. Sequestration can also be increased on rangelands or in on-farm plantings such as permanent crops, hedgerows, or riparian restoration projects.

Methane emissions from ruminant agriculture may be reduced by utilizing recommended feeding practices, dietary additives or agents that impact digestion efficiency, and/or longer-term breeding and management practices. However, further research is needed to understand and

quantify the impacts of practices to reduce direct methane emissions from livestock digestive processes.

Gaps in scientific knowledge and scientific uncertainty in existing data on many agricultural strategies make the identification of real, permanent, additional, verifiable and enforceable reduction measures difficult to immediately implement. The extent to which these and other voluntary GHG reduction activities occur may depend on the availability of economic incentives such as marketable emission reduction credits, grants, tax incentives, or renewable energy incentives, as well as the development of quantification protocols.

Recommended Actions

(A-1) Methane Capture at Large Dairies

Digesters are tanks or covered lagoons in which bacteria break down manure in an oxygen-free environment to create biogas, a mix of primarily methane (60 to 70 percent) and carbon dioxide (30 to 40 percent).[140] The biogas is captured in the tank or lagoon, and impurities removed prior to use in a turbine, IC engine, or fuel cell to create electricity, or injected into a utility natural gas pipeline. Regardless of the ultimate fate of the captured biogas, manure digester systems must meet local, state and federal air quality requirements, as well as water quality requirements. GHG reductions occur through operation of these systems because methane, which is 21 times as potent as CO_2 as a global warming pollutant, is captured and either utilized or destroyed instead of being directly released to the atmosphere.

Encouraging the capture of methane through use of manure digester systems at dairies will provide early voluntary emission reductions and promote the use of renewable energy. Economic incentives such as marketable emission reduction credits, favorable utility contracts, or renewable energy incentives will be key to early implementation. This voluntary approach in the initial years should encourage investment in the technology and improve cost effectiveness over time, which could help to facilitate a possible transition from a voluntary to a regulatory approach. The voluntary approach will be re-assessed at the five-year Scoping Plan update to determine if the program should be made mandatory for large dairies by 2020.

The manure digester protocol for quantifying GHG reductions approved by the Air Resources Board in September 2008 supports the implementation of this measure. This quantification methodology will ensure that voluntary reductions achieved are real, permanent, verifiable and enforceable. The installation and operation of digesters have potential cross-media impacts that must be assessed by multiple agencies including ARB, local air districts, State and Regional Water Boards and the California Integrated Waste Management Board. Increased regulatory coordination among these agencies is needed. Another issue highlighted by digester operators is that contracts from utilities contain few incentives for selling excess electricity or gas into the utility electrical grid or gas distribution system. ARB will continue to work with stakeholders and other agencies to encourage widespread capture of methane at large dairies.

[140] Managing Manure with Biogas Recovery Systems: Improved Performance at Competitive Costs. U.S. Environmental Protection Agency. http://www.epa.gov/agstar/pdf/manage.pdf

It is estimated that individual digester costs can range from $4-6 million for a dairy with at least 1,000 head. These costs include the digester tank or covered lagoon; electrical production equipment; manure solids separator; flare; biogas clean-up, upgrading, and processing equipment; and utility interconnection equipment. These costs also include annual operation and maintenance costs of about $100,000. Digesters have an estimated useful project life of about 15 years.

Appendix C: Agriculture
Table 33

Reduction Measure	Potential 2020 Reductions MMTCO_2E	Net Annualized Cost ($ Millions)†	Proposed Lead Agency	Adoption/ Implementation Timeframe
Methane Capture at Large Dairies	1	156	ARB	2017-2020

†The net cost of this GHG emission reduction strategy may not include the savings associated with emission control requirements necessary to obtain equivalent reductions of criteria pollutants reduced as a co-benefit, or the additional costs to control increased criteria pollutant emissions as a result of this measure. To the extent feasible, the net cost of emissions controls for criteria pollutants will be evaluated further in measure development.

Areas of Research/Opportunities for future GHG Emission Reductions

Assessing and Reducing N2O Emissions

The application of nitrogen fertilizers leads to emission of nitrous oxide (N_2O), a greenhouse gas. ARB is coordinating with the California Energy Commission and the California Department of Food and Agriculture on a research program to better understand the variables affecting emissions (Phase 1) and based on the findings explore opportunities for emission reductions (Phase 2).

N_2O accounts for roughly 15.6 MMTCO_2E, or 2.8 percent of California's 2004 Statewide GHG inventory. Current estimates indicate that agricultural soil produces more than 50 percent of overall N_2O emissions in California, contributing an estimated 8.3 MMTCO_2E. The N_2O in soil is primarily derived from nitrogen-rich substances such as plant residues, manure amendments, and nitrogen fertilizers. Because N_2O is generated through microbiological processes of nitrification and denitrification in soil as part of the natural nitrogen cycle, its emissions are closely related to the amount of nitrogen compounds in the soil. Continuing to improve the timing and application techniques of nitrogen sources into agricultural ecosystems, coupled with alternative agricultural management practices that affect physical, chemical, and biological properties of the soil environment (and consequently soil microbial activities), may offer opportunities to mitigate N_2O emissions.

The first step in this research effort is the establishment and validation of N_2O emission estimates under California-specific conditions, which will help refine the greenhouse gas emissions inventory. California has a unique opportunity to explore the effects of dynamic changes in soil moisture, due to controlled irrigation, on N_2O emissions. The N_2O inventory

assessment will inform subsequent work to identify strategies that reduce nitrogen losses (which can be up to 50 percent), prolong nitrogen residence time in soil, and benefit crop uptake.

Efficiency Improvements

Another aspect of the Agricultural sector's strategy is the potential opportunity to reduce GHG emissions through improved operational efficiency. These actions may not be applicable in all situations; to the extent that they are viable and desirable for individual farmers, the practices could be undertaken on a voluntary basis. Among the efficiency measures that could be pursued and developed for the future are continued improvements to water use efficiency and conservation, irrigation pump efficiency improvements, and maintenance of correct tire pressure to reduce fuel use by farm equipment.

Continued advances in agricultural water efficiency and conservation offer the potential for additional GHG reductions, as well as benefits for the State's water resources. The Agricultural sector accounts for approximately 80 percent of California's total water use and approximately 43 percent of California's total water supply.[141,142] Continued investment in water saving measures provides the opportunity to reduce water costs, preserve water resources, and reduce greenhouse gases.

Irrigation pump efficiency could be improved through on-site testing of agricultural water pumps, pump repairs, and the promotion of scientifically-determined irrigation scheduling practices. Such improvements would be expected to reduce either electricity or diesel fuel consumption for farmers, with associated cost savings.

Another opportunity for reducing fuel use is through the maintenance of correct tractor tire pressure when operationally feasible. Proper tire inflation based on the tire load can result in significant fuel savings, increased productivity, and reduced soil compaction during primary tillage operations, based on a UC Davis study.[143] The study found that tractors using correct tire pressure required approximately 20 percent less diesel fuel and increased productivity by 5 to 10 percent. The reduction in fuel consumption reduces both GHG and criteria pollutant emissions, and the reduced soil compaction could potentially reduce N_2O production in soil.

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[141] Department of Water Resources. Agricultural Water Use Program. http://www.owue.water.ca.gov/agdev/

[142] In addition to being a potential strategy to reduce GHG emissions, using water more efficiently may help the agricultural sector cope with potential reductions in water availability associated with the ongoing impacts of climate change on the hydrologic cycle.

[143] Lancas, K.P., S.K. Upadhyaya, and M. Sime. 1994. Traction and soil compaction due to low pressure tires. Unpublished report. Agricultural Engineering Department, University of California Davis

Appendix D: September 23, 2008 Western Climate Initiative Design Recommendations

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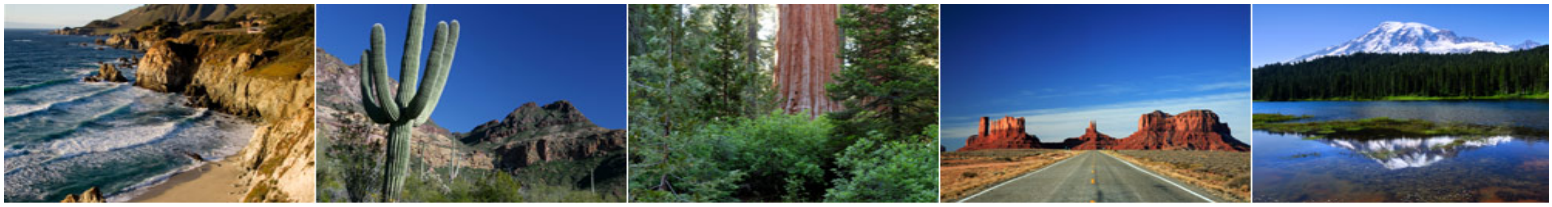


Western Climate Initiative

Design Recommendations for the WCI Regional Cap-and-Trade Program

September 23, 2008

Corrected Version: Issued March 13, 2009

Arizona *British Columbia* *California*

Manitoba *Montana* *New Mexico* *Ontario*

Oregon *Quebec* *Utah* *Washington*

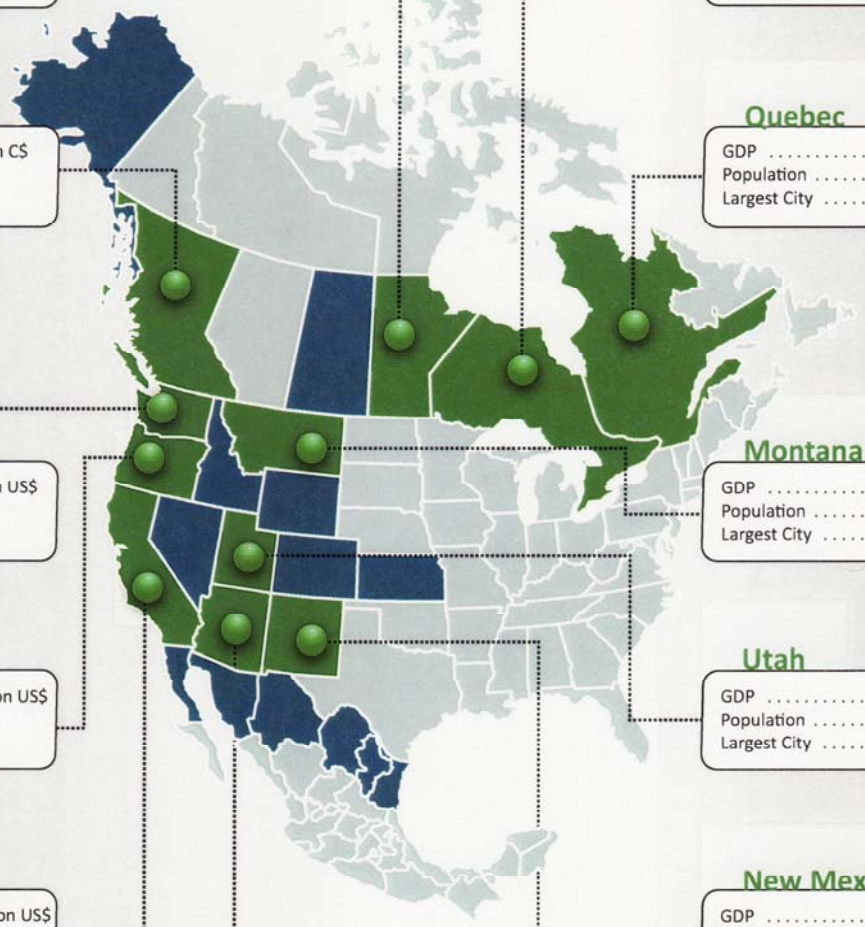
Western Climate Initiative

Manitoba
GDP ..... 48,586 Million C$
Population 1,186,700
Largest City..... Winnipeg

Ontario
GDP ..... 582,019 Million C$
Population 12,803,900
Largest City ..... Toronto

British Columbia
GDP ..... 190,214 Million C$
Population 4,380,300
Largest City ..... Vancouver

Quebec
GDP ..... 298,157 Million C$
Population 7,700,800
Largest City ..... Montreal



Washington
GDP ..... 311,270 Million US$
Population 6,468,424
Largest City ..... Seattle

Montana
GDP ..... 34,253 Million US$
Population 957,861
Largest City ..... Billings

Oregon
GDP ..... 158,233 Million US$
Population 3,747,455
Largest City ..... Portland

Utah
GDP ..... 105,658 Million US$
Population 2,645,330
Largest City ..... Salt Lake City

California
GDP ..... 1,812,968 Million US$
Population 36,553,215
Largest City ..... Los Angeles

New Mexico
GDP ..... 76,178 Million US$
Population 1,969,915
Largest City ..... Albuquerque

Arizona
GDP ..... 247,028 Million US$
Population 6,338,755
Largest City ..... Phoenix

Partners Observers

WCI OBSERVERS

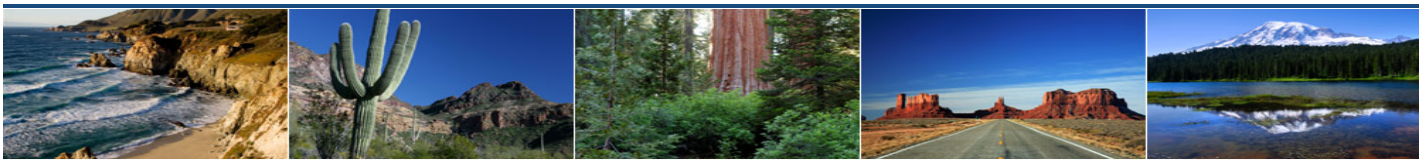
CANADA
Saskatchewan

UNITED STATES
Alaska
Colorado
Idaho
Kansas
Nevada
Wyoming

MEXICO
Baja California
Chihuahua
Coahuila
Nuevo Leon
Sonora
Tamaulipas

All figures for 2007
Source for US data: US Census Bureau and US Bureau of Economic Analysis
Source for Canadian data: Statistics Canada

Western Climate Initiative



September 23, 2008

To All Interested Parties:

In February 2007, the governors of Arizona, California, New Mexico, Oregon and Washington kicked off this ambitious effort to design a regional, market-based approach for reducing greenhouse gas emissions. Since that time, the governors of Montana and Utah and the premiers of British Columbia, Manitoba, Ontario, and Quebec have joined in this historic effort and today we are pleased to release our "Design Recommendations for the WCI Regional Cap-and-Trade Program."

Each of our states and provinces recognizes the need to take action now to address the threats posed by global climate change. The design recommendations being released today are an important milestone in our collective effort to respond to the leadership role states and provinces have established on this issue.

While we are pleased to reach this milestone, we recognize that much more remains to be done to move from program design to program implementation. Over the next couple of months, we will prepare a detailed work plan to guide the next phase of the Western Climate Initiative. The work plan will identify the priorities for the coming year and will provide information on how all interested parties can continue to engage in our process.

As we developed these recommendations over the last 18 months, we benefited greatly from the input provided by a wide variety of stakeholders representing business, industry, labor, and environmental groups. The dedication of our state and provincial staff and the assistance of our technical and policy advisors were also critical to our success.

On behalf of the governors and premiers of the Western Climate Initiative, we again thank you for your interest in our work and for your many contributions to date. We look forward to working with you as we move into the next phase of this initiative. We know that together we can meet the challenge of climate change while enhancing overall environmental health and economic vitality throughout the region.

Sincerely,

The WCI Partners

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Co-Chair, WCI

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Rob Greenwood and Bill Ross of Ross and Associates provided exceptional facilitation services during the last several negotiating sessions of the WCI, helping us get to success. Lydia Dobrovolny, also with Ross and Associates, provided critical support during the final negotiating sessions.

Karl Hausker, Glen Wood and their colleagues at ICF International and Jeff Amlin at Systematic Solutions, Inc. provided assistance to the WCI Economic Modeling Team as they evaluated a number of important questions related to the costs and benefits of the WCI cap-and-trade program.

Tim Smith with Waggener Edstrom Worldwide developed our communication tools with amazing speed. Deb Kinsley with the Western Governors' Association provided unparalleled service in making all of the arrangements for our Partner meetings and stakeholder workshops. We want to also thank Marcus Schneider and his colleagues at the Energy Foundation who provided the seed money to get this effort underway.

Our biggest thanks go to Pat Cummins with the Western Governors' Association. As our project manager, he kept us on track, on course and within budget. We simply would not have gotten through the process without Pat's assistance and support.

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Section 1: Design Recommendations for the WCI Regional Cap-and-Trade Program

The Western Climate Initiative (WCI) jurisdictions are recommending a design for a broad cap-and-trade program as part of a comprehensive regional effort to reduce emissions of global warming pollution to achieve the WCI 2020 regional goal. The recommended design will provide opportunities to obtain low-cost emission reductions through emission trading, allowance banking, and inclusion of an offsets component. The design is also intended to mitigate economic impacts, including impacts on consumers, income, and employment. The design balances all principles adopted by the WCI Partner jurisdictions to maximize total benefits throughout the region, including reducing air pollutants, diversifying energy sources, and advancing economic, environmental, and public health objectives, while also avoiding localized or disproportionate environmental or economic impacts. Finally, the WCI Partner jurisdictions have designed a program that can stand alone, provide a model for, be integrated into, or be implemented in conjunction with programs that might ultimately emerge from the federal governments of the United States and Canada.

1. Scope[1]

1.1. Greenhouse gases (GHGs) covered: Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

1.2. Emissions covered:

1.2.1. Electricity generation, including emissions from electricity generated outside the WCI jurisdictions (or generated by a federal entity or on tribal lands) that is delivered into a WCI Partner jurisdiction for consumption in that WCI Partner jurisdiction;

1.2.2. Combustion at industrial and commercial facilities;

1.2.3. Industrial process emission sources[2], including oil and gas process emissions;

1.2.4. Residential, commercial, and industrial fuel combustion at facilities with emissions below the WCI thresholds3 (as described below in the Point of Regulation section, these emissions will be covered upstream). Coverage of these emissions will begin at the start of the second compliance period;

[1] The *scope* defines the GHG emissions that are included in the cap-and-trade program, including the emission sources and GHG emissions that fall under the cap.

[2] As used here, process emissions include emissions from chemical, biological, and other non-combustion processes. These emissions may be deliberate (e.g., vented), fugitive (e.g., leaked), or accidental.

[3] *Thresholds* are emission levels that determine when a particular entity or facility will have a compliance obligation under the cap-and-trade program.

1.2.5. Transportation fuel combustion (as described below in the Point of Regulation section, these emissions will be covered upstream.) Coverage of these emissions will begin at the start of the second compliance period.

1.2.6. The WCI Partner jurisdictions recommend covering combustion from transportation, residential, commercial, and industrial (including electricity) fuel sources with the expectation that the individual WCI Partner jurisdictions will:

- Mitigate the economic impact on consumers;
- Implement other policies that will reduce GHG emissions from the transportation sector and reduce demand for transportation fuels (such as vehicle standards, smart growth, low carbon fuel standards, transit options, etc.); and
- Address any issues associated with the point of regulation and its implementation.

1.3. For biomass determined by each WCI Partner jurisdiction to be carbon neutral, the carbon dioxide emissions from the combustion of that biomass are not included in the cap-and-trade program, except for purposes of reporting.

1.4. Carbon dioxide emissions from the combustion of pure biofuels, or the proportion of carbon dioxide emissions from the combustion of biofuel in a blended fuel (e.g., B20 or E85), are not included in the cap-and-trade program, except for purposes of reporting.

1.5. Prior to program start, the WCI Partner jurisdictions will assess whether and how to include upstream emissions from biofuel and fossil fuel production, taking into consideration the potential for emissions leakage, the potential role of other policies (such as a low carbon fuel standard), consistent treatment among fuels, and other factors (such as practicality of implementation).

1.6. As described in Section 5, Role of Other Policies, WCI Partner jurisdictions acknowledge that individual jurisdictions may utilize other fiscal measures such as British Columbia's carbon tax, to address transportation fuels and fuel use by residential and commercial sources that contribute to achieving overall comparable GHG emission reductions and internalize the price of carbon as expected through the regional cap-and-trade program.

1.7. Adequate quantification methods will be established for emissions sources prior to including them in the program.

2. Point of Regulation[4]

2.1. Industrial sources (both process and combustion) with emissions above the threshold: The point of regulation will be at the point of emission.

2.2. Electricity: The point of regulation is the First Jurisdictional Deliverer (FJD). For sources within WCI jurisdictions, the FJD is the generator. For power that is generated outside the WCI jurisdictions (or generated by a federal entity or on tribal lands) for consumption within a WCI Partner jurisdiction, the FJD is the first entity that delivers that electricity over which the consuming WCI partner jurisdiction has regulatory authority.

2.3. Residential, commercial, and industrial fuel combustion at facilities with emissions below the threshold: The point of regulation will be where the fuels enter commerce in the WCI Partner jurisdictions, generally at a distributor. The precise point is to be determined and may vary by jurisdiction.

2.4. Transportation fuel combustion: The point of regulation will be where the fuels enter commerce in the WCI Partner jurisdictions, which for liquid fuels is generally at the terminal rack, final blender, or distributor. The precise point is to be determined and may vary by jurisdiction.

3. Thresholds for Coverage Under the Cap-and-Trade Program

3.1. Emission threshold: 25,000 metric tons of carbon dioxide equivalents (CO_2e) annually defines the entities or facilities (e.g., First Jurisdictional Deliverer, fuel distributor, fuel blender) that will have a regulatory compliance obligation under the cap-and-trade program. Mandatory reporting data may be used to adjust this threshold for specific industries where necessary. Additional analyses will be performed to determine if adjustments to the threshold are needed to ensure sufficient coverage or to address competitiveness issues within individual sectors prior to the beginning of the program (e.g., because different WCI Partner jurisdictions may have the same industry but with different sized sources).

3.2. A method will be developed to prevent entities or facilities from avoiding coverage, such as by breaking themselves into separate power deliverers that each deliver electricity with emissions below the threshold.

4. Program Expansion

4.1. Future Program Expansion: The scope of the cap-and-trade program is capable of expanding over time (including possibly adjusting applicability thresholds). Prior to each compliance period, the WCI Partner jurisdictions will review whether to bring new sources into the program and, if so, which ones.

---

[4] The *point of regulation* is the entity or facility with the compliance obligation, i.e., the requirement to surrender sufficient GHG allowances to cover actual emissions during the compliance period. An *allowance* is the tradable permit to emit one metric ton of GHG emissions in CO_2e. The term *entity* is generally used when the point of regulation is upstream of the point of emissions, to describe a company that has an obligation to surrender allowances to cover the carbon content of the fuel the company is moving through commerce, or when the point of regulation is at the First Jurisdictional Deliverer, to describe a company that has an obligation to surrender allowances to cover the emissions attributable to the generation of power the company is importing. When the point of regulation is at the point where the emissions occur, the term *facility* is generally used. The term *source* is used to refer to emissions from either a facility or an entity.

5. Role Of Other Policies[5]

5.1. The role of other GHG-reducing policies is to help the WCI Partner jurisdictions achieve their 2020 reduction goal and provide other benefits. Those policies will work in concert with the cap-and-trade program and may apply to any source of GHG emissions.

5.2. Carbon Tax and Other Fiscal Measures:

5.2.1. The WCI Partner jurisdictions agree that individual jurisdictions may use fiscal measures that contribute to achieving overall comparable GHG emission reductions and internalize the price of carbon as expected through the regional cap-and-trade program for transportation and residential/commercial fuels.

5.2.2. British Columbia currently has a carbon tax. By 2012, the WCI Partner jurisdictions will determine the mechanism for integrating the cap-and-trade program with the BC carbon tax.

6. Setting the Regional Cap[6]

6.1. The aggregate regional cap for the cap-and-trade program will:

6.1.1. Equal the sum of the WCI Partner jurisdictions allowance budgets (as referenced in Section 7.1).

6.1.2. Include annual caps (with 3-year compliance periods7) from the beginning of the program in 2012 through 2020. The annual caps will be set in advance of the program start in 2012 so that the total number of allowances issued in each 3-year compliance period through 2020 is known.

6.1.3. Decline over time. The regional cap trajectory for covered sectors will be a straight line from the year of initial coverage (2012 for some sources and 2015 for other sources) to 2020.

6.2. 2012: The initial regional cap will be set at the best estimate of expected actual emissions for those sources covered in the initial year of the program (i.e., 2012) as calculated through the Partner allowance budgets as described in 7.2.

---

[5] *Other policies* include complementary policies and alternative policies. A *complementary policy* is used in this context to mean policies other than a cap-and-trade program that aid in the goal of achieving emissions reductions for capped or uncapped sources. *An alternative policy* is a policy that is employed in lieu of a cap-and-trade program to achieve emissions reductions for one or more sources.

[6] The *regional cap* is the overall limit on total emissions set for the total emissions included in the cap-and-trade program.

[7] The 3-year compliance periods are 2012-2014, 2015-2017, and 2018-2020.

6.3. 2015: The regional cap in 2015 will be set by adding the best estimate of expected actual emissions in 2015 from transportation fuels and residential, commercial, and industrial fuels (and any other sectors or sources that may be added to the program for the first time in 2015) to the emissions trajectory for the sources first included in the program in 2012.

6.4. 2020: The regional cap for 2020 will be set so that reductions achieved by the cap plus reductions from other GHG reduction policies for uncapped sources will achieve the WCI regional 2020 goal.

6.5. Post-2020 caps: The WCI Partner jurisdictions will set these regional caps not less than three years in advance.

6.6. Once established, the regional cap for each compliance period will not be adjusted except as necessary to account for:

- Changes in WCI membership;
- Changes in scope or thresholds; or
- Data found to be incorrect or inaccurate that was used to determine the cap, which may become apparent, for example, after the start of mandatory reporting.

Any adjustments will be made prior to the beginning of the compliance period.

7. Apportionment[8]

7.1. Each WCI Partner jurisdiction will have an annual allowance budget within the declining regional cap from 2012 to 2020. The annual WCI Partner jurisdiction allowance budget for each year through 2020 will be set prior to the start of the program in 2012.

Each WCI Partner jurisdiction's 2020 allowance budget will be derived from its individual WCI Partner jurisdiction goal[9] used for purposes of the program, accounting for other policies described in Section 5.[10]

There are instances in which electricity is generated in one WCI Partner jurisdiction, but consumed in another WCI Partner's jurisdiction, giving rise to the possibility of double-counting emissions. WCI Partner jurisdictions in such situations will agree to an equitable solution in the context of the WCI cap-and-trade program design.

7.2. For 2012, each WCI Partner jurisdiction's allowance budget will be based on the best estimate of expected emissions for sources covered in the cap-and-trade program in the WCI Partner jurisdiction in 2012. The estimate of expected actual emissions in 2012 will be developed using the best available data (including any available mandatory reporting data) and by accounting for expected changes in emissions in 2012. Population growth, economic growth,

[8] *Allowance apportionment* describes the Partners' budget or share of WCI region-wide GHG emission allowances. Allowance budgets must be set for each Partner jurisdiction.

[9] Partner goals are those reduction goals or limits that have been established by each individual WCI Partner jurisdiction.

[10] By the end of 2009, Oregon will determine its cap-and-trade specific Partner goal at a level which is at least as stringent as the WCI regional goal.

voluntary and mandatory emission reductions, and other factors will be considered in making the estimate. Each WCI Partner jurisdiction's allowance budget will be adjusted to account for the production and consumption of electricity megawatt hours within each WCI Partner jurisdiction, population growth, and the share of total WCI Partner jurisdictions emissions in 2001 through 2005. Each WCI Partner jurisdiction will make a one-time contribution of 1% of their 2012 budget to be allocated to make these adjustments.

7.2.1. For 2015, each WCI Partner jurisdiction's allowance budget will be set by adding the best estimate of expected actual emissions in 2015 from transportation fuels and residential, commercial, and industrial fuels (and any other sectors or sources that may be added to the program for the first time in 2015) to the emissions trajectory for the sources first included in the program in 2012. The estimate of expected actual emissions in 2015 will be developed using the best available data (including any available mandatory reporting data) and by accounting for expected changes in emissions in 2015 for the sources added to the cap in 2015. Population growth, economic growth, voluntary and mandatory emissions reductions, and other factors will be considered in making the estimate.

7.2.2. From 2015-2020, the trajectory for each WCI Partner jurisdiction's annual allowance budget for covered sectors will be a straight line from the year of initial coverage (2012 for some sources and 2015 for other sources) to 2020.

7.3. For years post-2020, the WCI Partner jurisdictions will set allowance budgets not less than three years in advance.

7.4. Once established, each WCI Partner jurisdiction's allowance budget will not be adjusted except as necessary to account for:

- Changes in WCI membership;
- Changes in scope or thresholds; or
- Data found to be incorrect or inaccurate that were used to determine the cap or the WCI Partner jurisdiction allowance budgets, which may become apparent, for example, after the start of mandatory reporting.

Such adjustments will take effect at a regionally coordinated and designated time, such as at the beginning of a compliance period.

7.5. WCI Partner jurisdictions will recognize within their own jurisdictions allowances issued by other WCI Partner jurisdictions so that all WCI allowances are of equivalent use and fungible throughout the WCI region, regardless of which WCI Partner jurisdiction issues the allowances.

8. Distribution of Allowances[11]

8.1. Distribution of Allowances by WCI Partner jurisdictions: Once the allowance budget has been established for each WCI Partner jurisdiction, allowances will be issued by each WCI Partner within its own jurisdiction. Each allowance will be equal to one metric ton of carbon dioxide equivalent.

8.2. The WCI Partner jurisdictions agree that a portion of the value represented by each WCI Partner jurisdiction's allowance budget (for example, through set-asides of allowances, a distribution of revenues from the auctioning of allowances, or other means) will be dedicated to one or more of the following public purposes which are expected to provide benefits region wide:[12]

- Energy efficiency and renewable energy incentives and achievement;
- Research, development, demonstrations, and deployment (RDD&D) with particular reference to carbon capture & sequestration (CCS); renewable energy generation, transmission and storage; and energy efficiency;
- Promoting emission reductions and sequestration in agriculture, forestry and other uncapped sources; and
- Human and natural community adaptation to climate change impacts.

8.3. The remaining portion of the value represented by each WCI Partner jurisdiction's allowance budgets will be used as that jurisdiction sees fit. WCI Partner jurisdictions may consider objectives such as:

- Reducing consumer impacts, especially for low-income consumers;
- Providing for worker transition and green jobs;
- Achieving emission reductions in communities that experience disproportionate environmental impacts;
- Supporting community-wide efforts funded by local governments to reduce GHG emissions;
- Providing transition assistance to industries;
- Recognizing early actions to reduce emissions; and/or
- Promoting economic efficiency.

8.4. In advance of the first compliance period, and at least one year before the beginning of each relevant compliance period thereafter, each WCI Partner jurisdiction will advise the other WCI Partner jurisdictions how it intends to distribute or retire allowances so that all WCI Partner jurisdictions' plans can be made public in a coordinated fashion.

8.5. If analysis demonstrates that allocations to a particular sector should be treated uniformly by some WCI Partner jurisdictions in order to address competition among like facilities or entities within that sector, and if from that analysis some WCI Partner jurisdictions determine that it is necessary to address those competitiveness issues between the WCI Partner jurisdictions where the facilities or entities operate, those WCI Partner jurisdictions will

[11] *Allowance distribution* is the Partners' initial distribution of GHG emission allowances into the market.

[12] This will recognize pre-existing commitments to action and legislative requirements on use of revenue (e.g., through BC's Climate Action Plan and Carbon Tax).

standardize the distribution of allowances as necessary to address competitive impacts sufficiently, in advance of the first compliance period.

- Potential sectors where analysis to consider similar treatment is appropriate include those with process (non-combustion) emissions where the greatest emission reduction potential is associated with large technology changes and high GHG emission intensity, such as aluminum, steel, cement, lime, pulp and paper, and oil refining.
- Some WCI Partner jurisdictions may also decide that based on analysis of competitive factors in the electricity sector, distribution of allowance value or auction revenues in that sector should be standardized between those WCI Partner jurisdictions where competitive issues are recognized.

8.6. A WCI Partner jurisdiction will allocate or retire all the allowances in its allowance budget by the end of the applicable compliance period. Except as provided in Section 8.10, a WCI Partner jurisdiction will not hold allowances beyond the end of the compliance period.

8.7. Recognizing the WCI Partner jurisdictions objective of standardizing treatment of some sectors, and acknowledging the differences in the appropriate use of auctions by sector:

8.7.1. Consistent with applicable state and provincial law, the WCI Partner jurisdictions will auction a minimum of 10% of the allowance budget in the first compliance period beginning in 2012. This minimum percentage will increase to 25% in 2020. The WCI Partner jurisdictions aspire to a higher auction percentage over time, possibly to 100%.

8.7.2. Each WCI Partner jurisdiction has discretion to auction a greater portion of its allowance budget as it sees fit.

8.7.3. If a WCI Partner jurisdiction cannot auction allowances, that Partner jurisdiction will notify the other WCI Partner jurisdictions at least six months before the beginning of auctions scheduled for each compliance period. The fact that a WCI Partner jurisdiction cannot auction allowances shall not preclude the other Partner jurisdictions from doing so.

8.8. To the extent WCI Partner jurisdictions auction allowances, those jurisdictions will undertake auctions through a coordinated regional auction process by which each participating WCI Partner jurisdiction will auction allowances throughout the WCI region and receive their proceeds from the auction.

8.9. By the end of 2009 the WCI Partner jurisdictions will develop a design for the coordinated regional auction process. The WCI Partner jurisdictions will design the auction process to consider and prevent market manipulation.

8.10. To manage the risk of inadvertently setting the program cap higher than intended relative to emissions covered by the program, a reserve or minimum price will be established for a portion of the auctioned allowances. Consistent with applicable state and provincial law, this portion will equal 5% of allowances issued by any WCI Partner jurisdiction. If any of these allowances

when offered at auction are not purchased at or above the reserve or minimum price, a fraction of the unsold ones will be retired. The unsold allowances that are not retired may be auctioned in later compliance periods or retained by the individual WCI Partner jurisdictions for use as each sees fit in later compliance periods, as determined in advance by the WCI Partner jurisdictions. Any WCI Partner jurisdiction that does not participate fully in the auction with the reserve or minimum price will retire the same proportion of its allowance budget as those retired by the WCI Partner jurisdictions that participated in the auction. The percentage of the allowance budgets, the reserve price, the fraction of unsold allowances that will be retired, and the fraction of unsold allowances that will be retained by the individual WCI Partner jurisdictions will be determined as part of the auction design.

8.11. Early Reduction Allowances. The program will encourage entities and facilities included under the cap to reduce GHG emissions before the start of the first compliance period in 2012.

8.11.1. Each WCI Partner jurisdiction may issue Early Reduction Allowances for certain emissions reductions at covered entities and facilities within its jurisdiction that are achieved after January 1, 2008 and before January 1, 2012.

8.11.2. By the end of 2009, the WCI Partner jurisdictions will jointly establish criteria to determine which early reductions will be eligible for Early Reduction Allowances. The criteria will ensure that the reductions are voluntary, additional, real, verifiable, permanent and enforceable.

8.11.3. Each WCI Partner jurisdiction that issues Early Reduction Allowances will do so in 2012. Any Early Reduction Allowances issued will be in addition to each WCI Partner jurisdiction's 2012 allowance budget.

8.11.4. These allowances shall be treated like other allowances in the cap-and-trade program.

8.12. Other Early Actions and Set-Asides: Each WCI Partner jurisdiction has discretion to recognize early actions other than those under Section 8.11, or otherwise set-aside allowances for distribution. Recognition for early action or set-asides under this subsection will come from within the cap and will come out of the individual WCI Partner jurisdiction's allowance budget.

8.13. Banking: Purchasers and covered entities or facilities, and parties who otherwise obtain allowances, will be allowed to bank allowances without limitation, except to the extent that restrictions on the number of allowances any one party may hold are necessary to prevent market manipulation.

8.14. Borrowing: Borrowing of allowances from future compliance periods will not be allowed.

8.15. Compliance Periods: Each compliance period will be three years long.

9. Offsets,[13] and Allowances From Other Systems

9.1. The WCI Partner jurisdictions will include a rigorous offsets system. The primary role of the offsets system is to reduce the compliance costs for the cap-and-trade program, while ensuring the environmental integrity of the cap.

9.2. The WCI Partner jurisdictions will limit the use of all offsets, and allowances from other GHG emission trading systems that are recognized by the WCI Partner jurisdictions, to no more than 49% of the total emission reductions from 2012-2020 in order to ensure that a majority of emission reductions occur at WCI covered entities and facilities. Each WCI Partner jurisdiction will have the discretion to set a lower percentage limit. All offsets and non-WCI allowances must meet the rigorous criteria established by the WCI Partner jurisdictions.

The WCI Partner jurisdictions will establish criteria to ensure that all offset projects used to meet a compliance obligation result in a GHG reduction, removal or avoidance that is real, surplus/additional, verifiable and permanent or that meets a comparably rigorous standard as described in Section 9.7 below. Offset projects must also be enforceable by the individual WCI Partner jurisdiction that is issuing the credit and the credit must be verifiable by the individual WCI Partner jurisdiction that is accepting it. The criteria will ensure that the quantification of the GHG reduction, removal, or avoidance is accurate and not double counted. The standards and processes for approving offset projects will be developed and implemented in an open and transparent manner that will be well-defined in advance of the start of the cap-and-trade program.

9.3. The WCI Partner jurisdictions encourage the development of offset–projects located inside WCI jurisdictions for compliance purposes in the WCI cap-and-trade regulatory program in order to capture collateral benefits associated with some offsets projects, such as health, social, and environmental benefits.

9.4. The WCI Partner jurisdictions have identified the following list of project types as a priority for investigation and development to participate in the offset system. Making these project types a priority means the WCI Partner jurisdictions are interested in understanding if they are suitable for the offset system, if they will meet the criteria for environmental integrity, and if adequate protocols/methodologies for their quantification and monitoring can be adapted or developed. Priority does not mean these project types are guaranteed to be in an offset system. Project types that reduce emissions that would eventually be covered by the cap-and-trade system would only be eligible until that coverage begins. Project types that reduce emissions covered by the cap-and-trade system would not be eligible to create offsets because the result would be a double counting of the emission reduction. The list is in alphabetical order and does not directly or indirectly represent a ranking or order of preference:

[13] *Offsets* are emission reduction projects undertaken to address emissions not included in a cap-and-trade program. An offset mechanism enables covered entities to offset their own emissions by purchasing emission reduction credits generated through projects that address emissions not covered by the cap.

- Agriculture (soil sequestration and manure management);
- Forestry (afforestation/reforestation, forest management, forest preservation/conservation, forest products); and
- Waste management (landfill gas and wastewater management).

9.5. Starting in 2009, the WCI Partner jurisdictions will coordinate to review, develop, and approve, as appropriate, protocols for the project types that meet the necessary criteria for inclusion. The WCI Partner jurisdictions will use offset protocols that are standardized to the extent possible and make use of (or adapt if needed), existing protocols as appropriate. The WCI Partner jurisdictions will also initiate the establishment of a process during 2009 to coordinate the review and approval of other project types and protocols proposed by project developers. The WCI Partner jurisdictions will establish rigorous criteria for inclusion of offsets in the WCI program.

9.6. WCI Partner jurisdictions will recognize offsets meeting the WCI criteria within their own jurisdictions regardless of which WCI Partner jurisdiction issued them, so that all WCI offsets are of equivalent use and fungible throughout the WCI region. Offsets not meeting the WCI criteria will not be accepted for compliance purposes.

9.7. WCI Partner jurisdictions may approve and certify offset projects located throughout the United States, Canada, and Mexico where such projects are subject to comparably rigorous oversight, validation, verification, and enforcement as those located within the WCI jurisdictions. WCI Partner jurisdictions will not approve offset credits for GHG reductions in developed countries (Annex 1 countries in UN Framework Convention on Climate Change) for projects that reduce, remove, or avoid emissions from sources that within WCI Partner jurisdictions are covered by the cap-and-trade program.

9.8. The WCI Partner jurisdictions may accept offset credits from developing countries through the Clean Development Mechanism (CDM) of the Kyoto protocol, and the WCI Partner jurisdictions may establish added criteria to ensure similar rigor to WCI approved/certified offset projects or other requirements, such as international offset standards, as appropriate to enable use of these offset credits in the cap-and-trade program.

9.9. The offset protocols used by the WCI Partner jurisdictions will meet rigorous criteria to preserve the environmental integrity of the overall cap-and-trade program.

9.10. WCI Partner jurisdictions do not intend to regulate or restrict the existing voluntary market in offsets, to restrict the sale of offsets from projects located within a WCI Partner jurisdiction, or to place restrictions on ownership of offsets projects located within WCI Partner jurisdictions.

10. Reporting

10.1. Mandatory measurement and monitoring for the six included GHG emissions will commence in January 2010 for all entities and facilities subject to reporting. Reporting of 2010 emissions will begin in early 2011.

10.2. The entities and facilities subject to reporting are those with annual emissions equal to or greater than 10,000 metric tons of CO_2e. Where fuel combustion emissions are covered upstream (e.g., emissions from transportation fuel combustion and emissions from fuel combustion at residential, commercial, and industrial facilities with emissions below the threshold) the reporting threshold will apply to entities (e.g., fuel distributors and blenders) based on the expected combustion emissions from the fuels distributed. In some limited instances the threshold may be based on other parameters, such as throughput or capacity, as long as these thresholds represent the equivalent of, or are lower than, the 10,000-metric-ton threshold..

10.3. WCI Partner jurisdictions will require third party verification of reported emissions from entities and facilities that will be included under the cap.

10.4. Prior to the start of the mandatory reporting program, the WCI Partner jurisdictions will establish the essential requirements for reporting by all entities and facilities required to report in each of the WCI Partner jurisdictions.

10.5. As each WCI Partner jurisdiction collects additional emissions data from entities and facilities required to report, data will be made available to all WCI Partner jurisdictions for review and consideration for possible expansion of the cap-and-trade program.

10.6. Nothing in the WCI program design limits the discretion of any WCI Partner jurisdiction to require reporting earlier, at lower thresholds, or for entities and facilities not covered by the cap-and-trade program.

11. Start Date for Cap-and-Trade

11.1. The cap-and-trade program will launch January 1, 2012.

12. Compliance and Enforcement

12.1. Each WCI Partner jurisdiction will retain and/or enhance its regulatory and enforcement authority and responsibilities to enforce compliance with the cap-and-trade program within its own jurisdiction.

12.2. Each covered entity or facility will demonstrate compliance with the cap-and-trade program by surrendering sufficient allowances by July 1 of the year following the end of each compliance period. To ensure transparency and maintain public confidence, certain data from the emissions reports, allowances, and offsets that are used for compliance will be made public in a timely manner.

12.3. If by the deadline for demonstrating compliance a covered entity or facility does not have sufficient allowances to cover its emissions for the previous compliance period, it shall be required to obtain and surrender three allowances for every metric ton of CO_2e not covered by an allowance at the deadline. This does not preclude other penalties allowed under individual state or provincial laws.

12.4. The WCI Partner jurisdictions recognize that during the first compliance period, both they and the entities and facilities covered by the cap-and-trade program will likely encounter issues that arise in the implementation of any new program. Consequently, the WCI Partner jurisdictions are committed to providing appropriate technical and other compliance assistance to the program participants.

12.5. The WCI Partner jurisdictions will ensure accounting systems are in place to prevent using allowances, tradable units, and offsets more than once for compliance.

13. Regional Organization, New WCI Partner Jurisdictions, and Linkage

13.1. To reduce administrative costs and improve program transparency and consistency, a regional administrative organization will be created to:

- Coordinate the regional auction of allowances;
- Track emissions and provide public information on progress towards the WCI regional goal;
- Monitor and report on market activity, including any potential market manipulation;
- Serve as a forum for WCI Partner jurisdictions to update one another on program progress;
- Coordinate review and adoption of protocols for offsets;
- Coordinate review and adoption of updated reporting protocols;
- Coordinate review and issuing of offset credits; and
- Suggest criteria and means to accredit service providers to deliver validation and verification services.

13.2. New WCI Partner jurisdictions will come into the cap-and-trade program at a regionally coordinated and designated time, such as the beginning of the relevant compliance period.

13.3. Before joining, a new WCI Partner jurisdiction must have adopted an economy-wide GHG reduction goal for 2020 that is at least as stringent as the WCI regional goal.

13.4. Determination of allowance budgets for new WCI Partner jurisdictions will take into account the following parameters:

- The WCI regional goal;
- Allowance budgets for existing WCI Partner jurisdictions;
- The share of the new WCI Partner jurisdiction's budget that is already included through the WCI's regional cap-and-trade program provisions covering imported electricity; and
- The new Partner's individual GHG emissions reduction goal.

13.5. The WCI Partner jurisdictions will seek bilateral and multilateral linkages with other government-approved cap-and-trade systems so that those allowances and allowances issued by WCI Partner jurisdictions would be fully fungible. Until such bilateral or multilateral linkages are established, the use of allowances from other cap-and-trade systems will be limited as described in Section 9.2.

14. WCI Design and Possible Federal Programs

14.1. The WCI Partner jurisdictions have designed a program that can stand alone, provide a model for, be integrated into, or be implemented in conjunction with programs that might ultimately emerge from the federal governments of the United States and Canada. The WCI Partner jurisdictions intend to promote and influence federal GHG emission reduction programs that are consistent with WCI cap-and-trade design principles, and ensure those programs translate into absolute GHG reductions. In the event WCI issues allowances before a federal program in Canada or the United States, WCI Partner jurisdictions will work to ensure that those allowances are fully recognized and valued in the operation of a federal program.

14.2. The approach taken by the WCI Partner jurisdictions builds upon the experience gained by the WCI Partner jurisdictions in developing and implementing climate change action plans and other market-based programs to address air quality issues, including the regional haze and acid rain programs in the United States. Continued leadership in developing a regional cap-and-trade program allows the WCI Partner jurisdictions to take important action now and promote and protect the interests of early actors in the design and implementation of future national and international programs. Taking action now to achieve emission reductions will position WCI Partner jurisdictions to be leaders in the carbon constrained future.

Section 2: Background Report on the Design Recommendations for the WCI Regional Cap-and-Trade Program[14]

The Western Climate Initiative (WCI) is a cooperative effort of seven U.S. states and four Canadian provinces (the "Partners") that are collaborating to identify, evaluate, and implement policies to reduce greenhouse gas (GHG) emissions, including the design and implementation of a regional cap-and-trade program.[15] The Initiative began in February 2007 with the governors of Arizona, California, New Mexico, Oregon, and Washington, who have since been joined by the premiers of British Columbia, Manitoba, Ontario, and Quebec, and the governors of Montana and Utah.[16] Participation in the WCI reflects each Partner's strong commitment to identifying, evaluating, and implementing collective and cooperative actions to address climate change. This Background Report accompanies the Design Recommendations for the regional cap-and-trade program.

The WCI cap-and-trade program is the most comprehensive cap-and-trade program designed to date. Nearly 90 percent of the GHG emissions in the states and provinces will be covered by the cap when it is fully implemented in 2015. It will include more sectors and emissions than either the Regional Greenhouse Gas Initiative (RGGI) in the northeastern United States, which covers the electricity sector only, or the European Union's Emissions Trading Scheme (EU ETS), which does not cover transportation or residential and commercial fuel use. Through its broad scope, the WCI program will reduce costs while reducing emissions across the economy. It will also spur growth in new green technologies, help build a strong clean-energy economy, and reduce dependence on foreign oil.

The Partner jurisdictions are motivated by the impacts of climate change already being felt in the region. Observed trends include rising temperatures leading to warmer, earlier springs and more frost-free days; changing precipitation patterns that include both prolonged drought and increased flooding, as well as shifts in springtime precipitation from snow to rain; changes in water availability due to earlier spring snowmelt, changes in available water volume, and increased evaporation from reservoirs; rising sea levels; and a growing number of large wildfires. Additional impacts expected from unabated climate change include more heat waves, shrinking glaciers and reduced snowpack, reduced biodiversity as invasions of non-native species increase and local habitat moves northward and to higher elevations, and reduced air quality due to elevated levels of ozone and

[14] No statement in this document should be taken to contradict the Design Recommendations released concurrently with this Background Report; any perceived conflict should defer to the Design Recommendations.

[15] The complete text of the February 26, 2007 Memorandum of Understanding can be found in Appendix A.

[16] The states of Alaska, Colorado, Idaho, Kansas, Nevada, and Wyoming participate as observers, as do the province of Saskatchewan and the Mexican border states of Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas.

particulates. These impacts affect a wide range of economic sectors, from electricity generation to public health, from agriculture to tourism. The cost of inaction is enormous.

The analyses conducted on the WCI design suggest that the region can mitigate the costs of reducing emissions and realize a cost savings through increased efficiencies and reduced fuel consumption. These savings come in addition to the benefits the region will accrue from a cleaner environment and the promotion of investment and innovation to accelerate the transition to a green economy. The WCI cap-and-trade program is a winning proposition for Partner jurisdictions.

The initial phase of the WCI cap-and-trade program will be a time of transition during which WCI Partner jurisdictions will manage risks, protect the economy, and see real reductions in greenhouse gas emissions. Action is needed now to reduce greenhouse gas emissions and to adapt to climate change impacts. Working together, the states and provinces in the WCI are leading the way.

1. Public Comments and Discussion of WCI Recommendations

The process that led to the recommended design of the regional cap-and-trade program was careful and deliberative. At each step of design development, the WCI Partners sought extensive stakeholder input, as described in part 3.1.3, which yielded a great volume of comments on the range of issues confronted by participating WCI Partner jurisdictions. The comments submitted to the WCI Partner jurisdictions have been posted on the WCI website.[17] The WCI Partners carefully reviewed and considered stakeholder comments in order to formulate the design recommendations for the cap-and-trade program.

This section elaborates on the key program design recommendations. Each design element is defined and the design recommendation is summarized. Stakeholder input on the design element is reviewed briefly. Finally, the WCI Partners' recommendation is discussed in light of stakeholder input, the balancing required between disparate stakeholder positions, lessons learned from other cap-and-trade programs, economic analyses, and expert opinion. The design recommendations also rely on the design principles adopted by the WCI Partner jurisdictions and the overarching program goal of ensuring that greenhouse gas (GHG) emissions are reduced within the WCI Partner jurisdictions.

In conjunction with the cap-and-trade program, individual WCI Partner jurisdictions will:

- Mitigate economic impacts on consumers;
- Implement other policies that will reduce GHG emissions from the transportation sector and reduce demand for transportation fuels (such as vehicle standards, smart growth, low carbon fuel standards, and transit options); and

[17] www.westernclimateinitiative.org.

- Address jurisdiction-specific issues associated with the point of regulation and its implementation.
- If any of the design elements differ between the Design Recommendations and the following explanatory text, the Design Recommendations take precedence.

1.1. Scope

1.1.1. Definition

The *scope* defines the GHG emissions that are included in the cap-and-trade program, including the sectors, emissions sources, and greenhouse gases that fall under the cap. The cap is the absolute aggregate limit on GHG emissions.

1.1.2. Design Recommendation

The WCI Partner jurisdictions recommend a multi-sector greenhouse gas cap-and-trade program covering emissions of the six major GHGs: carbon dioxide, methane, nitrous oxide, perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride.[18] In the initial compliance period beginning in 2012, the program will cover emissions from electricity, including imported electricity; industrial combustion at large sources; and industrial process emissions[19] for which adequate quantification methods exist. In the second compliance period, beginning in 2015, the program will expand to cover fuels combusted at industrial, residential, and commercial buildings that are not otherwise covered as emissions sources, as well as transportation fuels. The first compliance period of the program will include about half of the economy-wide emissions in the WCI Partner jurisdictions. Starting with the second compliance period, the program will include about 90 percent of emissions. The program is capable of expanding further over time based on new information.

The carbon dioxide emissions from the combustion of biomass that are determined to be carbon neutral will not be covered by the cap-and-trade program emissions cap. Similarly, the carbon dioxide emissions from the combustion of bio-fuels or the bio-fuel component of blended fuels will not be covered by the program emissions cap. However, carbon dioxide emissions from biomass, bio-fuels, and the bio-fuel component of blended fuels will be subject to the program reporting requirements. The WCI Partner jurisdictions are continuing to assess whether and how to include upstream emissions from bio-fuel and fossil fuel production that do not take place within the WCI Partner jurisdictions.

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[18] The Scope Draft Design Recommendations describes the options considered by the scope subcommittee, the evaluation criteria applied to the options, the data and analytical inputs (including data on emissions, numbers of entities, and potential cost impacts), and the decision process for deciding on the recommendations. Available at www.westernclimateinitiative.org/ewebeditpro/items/O104F16031.PDF.

[19] As used here, process emissions include emissions from chemical, biological, and other non-combustion processes. These emissions may be deliberate (e.g., vented), fugitive (e.g., leaked), or accidental.

Individual jurisdictions may utilize comparable fiscal measures, such as British Columbia's carbon tax, to address transportation fuels and fuel use by residential and commercial sources, and industrial fuels not otherwise covered at the emissions source. Adequate quantification methods will be established for emissions sources before they are included in the program.

1.1.3. Stakeholder Input

Stakeholder comments expressed strong support for the broadest possible coverage of sources and emissions under the cap-and-trade program. Factors identified by stakeholders supporting a broad scope include:

- To provide greater certainty that economy-wide emission reductions will be achieved;
- To reduce compliance costs by covering a broad set of emissions sources with diverse emission reduction opportunities;
- To create a level playing field for all fuels;
- To ensure that carbon is priced throughout the economy; and
- To create a more robust GHG trading market.

Many stakeholders stressed the importance of having reliable measurement, monitoring, and reporting protocols in place in order to include an emissions source in the program. For example, stakeholders from the waste management industry highlighted their view that the quantification protocols for landfill methane emissions cannot currently calculate methane emissions at individual landfills with adequate precision for a cap-and-trade program.

Considerable input was received on whether to include transportation fuels in the cap-and-trade program. Many stakeholders supported including transportation fuels in the program, emphasizing that these fuels are the largest source of GHG emissions across the WCI Partner jurisdictions and for most of the individual jurisdictions. They argued that these fuels need to be included to ensure that the economy-wide emission reduction goals can be achieved. Some stakeholders pointed out that if transportation fuels were omitted from coverage, then they would enjoy a competitive advantage over electricity as a vehicle fuel, since electricity would be covered by the program. Stakeholders also provided analyses indicating that including transportation fuels will reduce the concentration of the carbon trading market by including significant additional participants. Reduced concentration may help protect against market manipulation and provide for a more robust market.

A small group of stakeholders expressed opposition or hesitation to including transportation fuels citing concerns regarding: economic impacts, particularly on low-income communities; administrative complexity; and the lack of technical options for reducing reliance on fossil-carbon-based fuels. Some stakeholders suggested that the demand for transportation fuels has been shown to be highly inelastic, so that there would be little emission reduction achieved by including the fuels in the program. Other stakeholders cited analyses suggesting that the demand for transportation may be inelastic, but the demand for traditional transportation fuels was or is becoming increasingly elastic.

The timing for including transportation fuels in the program was also the subject of considerable input. Some stakeholders said it was best to include the fuels in the first compliance period, in particular to internalize the price of carbon as soon as possible. Others said that a delay in coverage was warranted to allow the point of regulation to be adequately determined and to enable complementary policies to enhance the availability of options for reducing emissions.

Stakeholders also commented on whether and when residential and commercial fuels should be included in the cap-and-trade program. Some stakeholders expressed concerns regarding economic impacts and administrative complexity. Some commented that direct use of natural gas at a residence or business is a more efficient use of that fuel than using it to generate electricity and, for this reason, should be excluded from coverage in the program. It was also argued that energy efficiency programs would be a more effective method of reducing emissions from these fuels. Others stressed the importance of creating a level playing field across all fuels, indicating that natural gas competes with electricity in residential and commercial applications.

The inclusion of industrial process emissions was also the subject of stakeholder input. Stakeholders pointed out that some process emissions are due to chemical reactions that are fundamental to their production processes. They recommended that these "fixed process emissions" be excluded from the program. Similarly, some stakeholders suggested that the process emissions from geothermal electricity generation should be excluded because geothermal electric generation is a low-emitting process.

Issues were also raised by stakeholders related to incorporating combined heat and power (cogeneration) into the program since it has implications in both the industrial and electricity sectors.

1.2. Discussion of WCI Partners' Recommendation

The WCI Partner jurisdictions have weighed all input carefully and have proposed a program scope that best achieves the program objectives and addresses stakeholder concerns. The WCI Partners are persuaded by the multiple benefits of having as broad a scope as possible, including transportation fuels and fuels for residential, commercial, and small industrial users along with electric sector emissions and industrial emissions. Recognizing that transportation fuels are the largest source of GHG emissions in the region, the WCI Partners have concluded that transportation fuels must be included in order to achieve the objective of reducing emissions not only by 2020, but by 2050. Additionally, the WCI Partners believe that it is important to internalize the cost of carbon throughout the economy and to ensure a level playing field across all fuels. Consequently, the WCI Partners have also concluded that there are important benefits from including transportation fuels and fuels for residential, commercial, and small industrial users.

The timing of the coverage of transportation fuels and fuels for residential, commercial, and small industrial users was considered carefully. While there are benefits of including these fuels starting with the first compliance period, multiple factors necessitated covering them starting in the second compliance period. Electric sector emissions and industrial emissions are traditional emissions sources regulated in the context of clean air regulations. In the WCI Partners' judgment, it is practical to cover these sectors from the start of the program in 2012.

Emissions from fuels for residential, commercial, and small industrial users and transportation fuels are different than those typically dealt with by regulatory agencies under either the U.S. or Canadian Clean Air Acts. The WCI Partner jurisdictions concluded that it is important to have time to develop clear requirements for the entities that will have a regulatory obligation for these emissions, including how to calculate or measure their emissions. In addition, the Partner jurisdictions believe it is important for other policies that will reduce overall consumer demand for these fuels (such as the California clean car standards and strategies to reduce vehicle miles traveled, and to increase the use of low carbon or other "cleaner" fuels) be put in place before these fuels are covered by the cap-and-trade program. The WCI Partner jurisdictions recognize the importance of increased emphasis on energy efficiency to reduce fuel combustion in residential, commercial, and small industrial uses. The WCI Partner jurisdictions also believe it is important to develop strategies to address any potential consumer impacts from covering these emission sources in advance of the second compliance period.

All process emissions with adequate quantification methods will be included in the program. The WCI Partner jurisdictions believe that it is important to incorporate the price of carbon throughout the economy, including in products with fixed process emissions. However, the WCI Partners also recognize that the competitive position of some industrial sources could be affected by this decision. Consequently, the WCI Partners are continuing to evaluate the potential competitive impacts on these sources and will address these impacts if they are found to be significant.

Economic analyses support the recommendation for broad coverage in the cap-and-trade program. The analysis conducted for the WCI Partners is consistent with the body of literature supporting a broad scope, including transportation fuels. In particular, the analysis found that compliance costs can be reduced if the program includes a broad scope.

The WCI Partner jurisdictions recognize the importance of combined heat and power (cogeneration) in the program scope and are continuing to evaluate its implications for the program design.

1.3. Point of Regulation

1.3.1. Definition

The *point of regulation* is the entity or facility with the compliance obligation. The term *entity* is used (a) when the point of regulation is upstream of the point of emissions, to describe a company that has an obligation to surrender allowances to cover the expected emissions from the combustion of the fuel the company is moving through commerce, or (b) when the point of regulation is at the First Jurisdictional Deliverer, to describe a company that has an obligation to surrender allowances to cover the emissions attributable to the generation of power the company is importing. When the point of regulation is at the point where the emissions occur, the term *facility* is generally used. A *compliance obligation* is the requirement to surrender GHG allowances sufficient to cover actual emissions during the compliance period.

1.3.2. Design Recommendation

The WCI Partner jurisdictions are recommending the following points of regulation for the cap-and-trade program:

- For industrial process and combustion sources with emissions above the threshold, the point of regulation is at the facility that has the point of emissions.
- For entities generating and/or delivering electricity with attributed emissions above the threshold, the point of regulation is at the First Jurisdictional Deliverer. This means at the facilities generating power within the WCI Partner jurisdictions and at the first entity over which a Partner has regulatory authority that delivers electricity generated outside the WCI into a WCI Partner jurisdiction for consumption in that Partner jurisdiction.
- For residential, commercial, and industrial fuel combustion at facilities with emissions below the threshold, the point of regulation is where the fuels enter commerce in the WCI Partner jurisdictions, generally at a fuel distributor. The precise point will be determined before the fuels are brought into the program in 2015 and may vary by jurisdiction.
- For transportation fuel combustion, the point of regulation is where the fuels enter commerce in the WCI Partner jurisdictions, generally at the terminal rack, final blender, or distributor. The precise point will be determined before these fuels are brought into the program in 2015 and may vary by jurisdiction.

1.3.3. Stakeholder Input

Stakeholders provided a broad range of comments regarding the preferred points of regulation for the various emissions included in the program. Some stakeholders supported a point of regulation as close to the point of emissions as is practical in order to provide a

regulatory obligation on the actual emitter. Other stakeholders supported an upstream point of regulation, particularly for transportation and other fuels in order to provide as broad coverage as possible.

The WCI Partner jurisdictions received a great variety of comments on the point of regulation for the electricity sector. A majority of commenters favored some approach to cover emissions associated with electricity from outside the WCI Partner jurisdictions. However, there was a wide variety of opinions on how best to cover emissions from imported electricity. A specific challenge relative to covering all deliverers of electricity is the need to track the emissions from the point of generation to the point of delivery inside the WCI Partner jurisdictions. Some commenters observed that, considering this challenge, the WCI Partners should start with a generator-based only point of regulation for electricity, then expand to include power imported for consumption into the WCI Partner jurisdictions once the tracking issue was resolved. Some stakeholders suggested that the tracking issues are complex enough that additional technical assessment is necessary to ensure an adequate approach can be successfully deployed.

1.3.4. Discussion of WCI Partners' Recommendation

In selecting the point of regulation for the different covered sources, the WCI Partner jurisdictions considered the experience of prior cap-and-trade programs, the administrative requirements for the covered facilities and entities, the number of facilities and entities that would be included, and especially given the regional nature of the program, the potential for leakage. For industrial facilities, the point of regulation will be at the facility with the source of the emissions, putting the regulatory obligation at the point of emission. Because there are a very large number of small combustion sources in the transportation, residential and commercial sectors, and at small industrial facilities, the Partner jurisdictions decided it would be impractical to regulate at the point of emissions for these sectors. Rather, the WCI Partners found that these emissions can best be covered upstream at the point of entry of the fuel into the region's economy. By starting the inclusion of these fuels in the second compliance period, the Partners have allowed sufficient time to address issues related to defining the precise upstream point of regulation for these sources.

For electricity, the point of regulation will be at the First Jurisdictional Deliverer. The First Jurisdictional Deliverer is the generator of electricity in a WCI jurisdiction, or the first deliverer of electricity that is generated outside the region to be consumed within a WCI Partner jurisdiction. Emissions associated with power that is wheeled through the WCI Partner jurisdictions but not consumed in any of them is not covered by the program. The Partners recognize that there will be challenges to tracking emissions from the source where electricity is generated to the jurisdiction where it will be consumed. However, the WCI Partners also recognize that a significant amount of electricity consumed in the WCI Partner jurisdictions is generated by federal entities, on tribal land, or in non-WCI jurisdictions. Due to the interconnected nature of the electric grid, leakage of electricity emissions to jurisdictions or entities that are not part of the WCI is a significant concern that the First Jurisdictional Deliverer point of regulation is intended to address. Additionally, the Partners

determined that this point of regulation can best address leakage while maintaining compatibility with wholesale electricity markets.

The recommendation to put the electricity point of regulation at the First Jurisdictional Deliverer represents a WCI innovation to eliminate emissions leakage. Previous programs—such as the Regional Greenhouse Gas Initiative, which follows a pure generator-based approach—have generally failed to address the leakage potential at all. As a new approach, First Jurisdictional Deliverer will pose some new challenges to implement. Given these challenges, work will continue on the First Jurisdictional Deliverer approach, including additional opportunities for stakeholder input during five stakeholder technical working sessions scheduled through the fall and winter of 2008/09. These meetings will provide the WCI Partners, technical experts, and other stakeholders additional opportunities to work together on key issues associated with the implementation of the First Jurisdictional Deliverer approach.

1.4. Thresholds Triggering a Compliance Obligation under the Cap-and-Trade Program

1.4.1. Definition

Thresholds are annual emission levels that are used to determine whether a particular entity or facility will have a compliance obligation under the cap-and-trade program.

1.4.2. Design Recommendation

The cap-and-trade program will apply an emissions threshold of 25,000 metric tons of CO_2e annually to determine the facilities or entities that will have a regulatory compliance obligation under the program.[20] Additional analyses, including data from mandatory reporting, will be performed to determine if adjustments to the threshold are needed to ensure sufficient coverage or to address competitiveness issues within individual sectors prior to the beginning of the program (i.e., because different Partner jurisdictions have the same industry but with different-sized sources). The WCI Partner jurisdictions will develop a method to prevent entities or facilities from avoiding coverage by breaking themselves into smaller units that individually have emission levels that are below the threshold.

1.4.3. Stakeholder Input

Stakeholders provided a broad range of comments regarding how best to apply emission thresholds. The comments were broadly consistent with the goal of covering the vast majority of emissions while reducing administrative burden by minimizing the number of entities and facilities with a direct compliance obligation. Stakeholders differed in their

[20] The Scope Draft Design Recommendations address the question of thresholds and include a section (Section 4.3) on considerations for setting emissions thresholds. Available at http://www.westernclimateinitiative.org/ewebeditpro/items/O104F16031.PDF.

balancing of these objectives, with some recommending lower thresholds, such as 10,000 metric tons of CO_2e annually, and at least one stakeholder recommending 100,000 metric tons annually. Sector-specific thresholds were also discussed, including thresholds defined in terms of production capacity (such as megawatt (MW) capacity for electric power generation) and other units.

Stakeholders also emphasized the importance of defining how the threshold would be applied, including the definition of "facility" or "entity" that would be used. The definition of facility was discussed particularly with reference to oil and gas production fields that may contain equipment dispersed over large areas. Some stakeholders inquired whether the threshold would be applied prospectively (i.e., prior to the start of the compliance period), annually during a compliance period, or after the end of the compliance period.

1.4.4. Discussion of WCI Partners' Recommendation

The WCI Partner considered a broad range of thresholds for the program, with the objective of covering a large portion of emissions (e.g., 90 percent of the emissions in the covered sectors) with as few facilities and entities as possible. The WCI Partner jurisdictions agree with the objective of minimizing the number of facilities and entities with a direct regulatory obligation to minimize the program's administrative burden for both the complying industries and the program administrators. The WCI Partners reviewed available data from several jurisdictions to assess how many facilities and entities would be expected to have compliance obligations and the portion of total emissions covered for a range of threshold values.[21] Based on this review, the WCI Partners concluded that current data support setting an emission threshold of 25,000 metric tons of CO_2e per year and that this threshold would cover more than 90 percent of emissions.

The WCI Partners recognize that additional data will be valuable for assessing the appropriateness of the threshold level. The comprehensive mandatory emissions reporting will provide more complete data, which will be examined to ensure that the threshold is set to achieve the level of program coverage desired. Of note is that by including residential, commercial, and small industrial fuels in the program at an upstream point of regulation, the threshold becomes less important for ensuring coverage of emissions from these fuels: the emissions at facilities below the threshold are covered upstream. Additionally, as discussed above, the WCI Partners will assess whether the threshold creates competitiveness impacts within industries.

[21] For example, The California Air Resources Board found that in California, a threshold of 25,000 metric tons of CO2 covered about 94 percent of emissions from stationary sources. A threshold of 10,000 metric tons of CO2 increased coverage to only 96 percent of emissions, but nearly doubled the number of regulated sources. See the Staff Report: Initial Statement of Reasons for Rulemaking, available online at http://www.arb.ca.gov/regact/2007/ghg2007/isor.pdf.

1.5. Program Expansion

1.5.1. Definition

Program expansion allows the cap-and-trade program to incorporate additional sectors, greenhouse gases, or facilities or entities under the cap, or to include a new Partner in the cap-and-trade-program.

1.5.2. Design Recommendation

The WCI Partner jurisdictions have designed a cap-and-trade program that is capable of expanding over time (including possibly adjusting applicability thresholds over time). Prior to each compliance period, the WCI Partner jurisdictions will review whether to bring new sources into the program, and if so, which ones.

1.5.3. Stakeholder Input

The great majority of stakeholders commenting suggested broad coverage to the extent practicable. Some also expressed a desire to bring all of the states and provinces that are part of the western interconnected electrical grid into the program.

1.5.4. Discussion of WCI Partners' Recommendation

A provision that allows for expansion over time is responsive to public comments calling for broad coverage of the cap-and-trade program. The scope of the program will expand from its initial coverage of industrial combustion and process sources and electricity sources in the first compliance period. In the second compliance period, transportation fuels will be included, along with residential, commercial, and industrial fuels serving facilities not covered by the program in the first compliance period. In addition, the program emissions threshold has been set initially at 25,000 metric tons of CO_2e annually, but will be revisited based on the mandatory emissions data to be reported by emissions sources region-wide, and additional facilities or entities may be brought into the program. Finally, the WCI Partner jurisdictions would like any states, provinces or tribes that have committed to making GHG emission reductions comparable to the WCI regional reduction goal to become Partners in the WCI.

1.6. Role of Other Policies

1.6.1. Definition

Other policies include complementary policies and alternative policies. A *complementary policy* is used in this context to mean policies other than a cap-and-trade program that aid in the goal of achieving emission reductions inside or outside the capped sectors. *An*

alternative policy is a policy that is employed in lieu of a cap-and-trade program for one or more sectors.

1.6.2. Design Recommendation

The role of other GHG-reducing policies is to help the WCI Partner jurisdictions achieve their 2020 reduction goal and provide other benefits. Those policies will work in concert with the cap-and-trade program and may apply to any source of GHG emissions.

In addition, the WCI Partner jurisdictions have agreed that individual jurisdictions may use fiscal measures that contribute to achieving overall comparable GHG emission reductions and internalize the price of carbon as expected through the regional cap-and-trade program for transportation and residential/commercial/small industrial fuel users. British Columbia currently has a carbon tax on these fuels. By 2012, the WCI Partner jurisdictions will determine the mechanism for integrating the cap-and-trade program with British Columbia's carbon tax.

1.6.3. Stakeholder Input

Many stakeholders emphasized the importance of complementary measures, especially for the residential, commercial, and transportation sectors. Others expressed concern that complementary measures would not provide the same level of certainty in emissions reductions from these sectors as would coverage under the cap.

1.6.4. Discussion of WCI Partners' Recommendation

The WCI Partner jurisdictions recognize that it will take numerous policies working in concert with cap-and-trade to achieve the regional reduction goal. The WCI economic analysis supports this point. It also makes sense: for example, codes that require energy efficient buildings complement the inclusion of electricity and residential, commercial, and small industrial fuel use under the cap.

In addition to aiding in the achievement of reductions at sources covered by the cap, complementary policies are needed for reductions at sources not covered by the cap-and-trade program. For example, during the first compliance period, the WCI Partners are recommending that complementary policies be instituted to reduce fuel demand in the transportation residential, and commercial sector, and by small industrial fuel users. This will help ensure consumers have real choices about the cars they drive, the fuels they use, and energy efficient appliances and buildings when these fuels are included in the cap-and-trade program in 2015.

The WCI Partner jurisdictions also agree that other policies, such as British Columbia's carbon tax, can be used as an alternative to cap-and-trade if designed to achieve comparable emission reductions and to internalize the cost of carbon for transportation fuel

and fuel use by residential, commercial, and small industrial sources, as expected through the cap-and-trade program.

1.7. Setting the Regional Cap for the Cap-and-Trade Program

1.7.1. Definition

The *regional cap* is the overall GHG emissions limit set for the facilities and entities covered by the cap-and-trade program. The cap declines over time to the desired reduction limit in 2020. For the WCI Partner jurisdictions, the program is designed to achieve their 2020 emissions goal.

1.7.2. Design Recommendation

The WCI Partner jurisdictions are recommending the following with respect to the aggregate regional emissions cap:

- The aggregate regional cap for the cap-and-trade program will (a) represent the sum of the WCI Partner jurisdictions allowance budgets; (b) include annual caps with three-year compliance periods, and (c) decline over time to reach the 2020 cap level.
- The initial 2012 regional cap will be set based on the best estimate of expected actual emissions. Among the factors that will be considered in making these estimates are population growth, economic growth, voluntary and mandatory emission reductions, and other factors including reporting data that is available when the cap is set. Of particular importance is that the voluntary emission reductions recognized through the issuance of Early Reduction Allowances be reflected in the estimates for the 2012 allowance budgets for each WCI Partner, and consequently the region as a whole (see Part 1.10 for a discussion of the Early Reduction Allowances). A mechanism will be developed that reconciles the 2012 allowance budgets for each Partner with the Early Reduction Allowances issued by each Partner.
- The 2015 regional cap will be set by adding the best estimate of actual emissions in 2015 from transportation fuels and residential, commercial, and industrial fuels (and any other sectors or sources that may be added to the program in 2015) to the emissions cap trajectory for the sources first included in the program in 2012.
- The 2020 regional cap will be set so that reductions achieved by the cap plus reductions from other GHG reduction policies will achieve the WCI 2020 regional emissions goal.
- Annual regional caps for calendar years 2012 through 2020 will be established before the start of the program in 2012 so that the total number of allowances issued in each three-year compliance period through 2020 will be known.
- The annual regional caps will only be adjusted for changes in WCI membership, changes in program scope or applicability thresholds, or to correct for data discovered

to be incorrect or inaccurate. Any adjustments will be made before the beginning of a compliance period.

1.7.3. Stakeholder Input

A number of stakeholders cautioned against beginning the cap-and-trade program with a cap that over-allocates emissions allowances, with some recommending use of actual, historic emissions as opposed to estimates of future emissions that rely on best available data. Many stakeholders expressed concern that setting the regional cap at the level of emissions expected in 2012 will encourage emitters to increase their emissions prior to the setting of the regional cap in order to increase the allowances in the system. Some stakeholders expressed support for setting the initial cap far ahead of the 2012 program start, so that the program reduces emissions in the first year and does not penalize early actions or create a "perverse incentive" for higher emissions before the program starts. Stakeholders were not unanimous on whether the cap should decline in a uniform straight line from the start of the program, or begin without a reduction and decline at an accelerating rate over time. Many stakeholders stressed the importance of having good emissions data for setting the cap to avoid over-allocation and to ensure more robust reductions from the program.

1.7.4. Discussion of WCI Partners' Recommendation

Recognizing that good emissions data will not be available before it is time to set the 2012 cap, the WCI Partner jurisdictions have accounted for the need to project actual emissions in the first year of the program. This projection will take into account population growth, economic growth, voluntary and mandatory emissions reductions, and other factors. Some WCI Partner jurisdictions will have limited emissions reporting in place prior to the recommended start of the WCI reporting in 2010; this reporting data will also be considered. The 2015 cap will bring in additional sectors under the cap, and the initial cap for these sectors will be established in a similar manner, with the reporting data playing a larger role.

The recommended approach for setting the 2012 emissions cap does not provide an incentive to increase emissions through 2012. The estimate for 2012 will be completed at the latest in 2010. Consequently, there is no opportunity to increase emissions prior to 2012 to influence the estimate of the 2012 emissions cap. Also, to provide an incentive to reduce emissions before the start of the program in 2012, the WCI Partner jurisdictions are recommending Early Reduction Allowances, which will provide allowances for certain voluntary reductions made during a specific period prior to 2012.

To guard against over-allocation, the WCI Partner jurisdictions have also recommended that the first five percent of the auctioned allowances have a minimum reserve price. If allowances are not purchased at or above the minimum reserve price, a portion will be retired, auctioned in a subsequent period, or distributed in a subsequent period. This

mechanism will serve to remove "extra" allowances from the market. This auction provision is detailed below in Part 1.9.

The WCI Partner jurisdictions are recommending that the annual regional caps from 2012 to 2020 follow a straight-line declining trajectory, recognizing that the total amount of allowances will increase in 2015 when transportation and other fuels are added to the program. It should be noted that the end point for 2020 will not change when those fuels are added. All caps will be established in advance of the start of the program in 2012 so that the reductions accomplished from the program will be known well in advance. Setting the caps in advance will also allow the WCI Partner jurisdictions to ensure the 2020 reduction goal will be met.

The economic modeling analysis suggests that the cap-and-trade program can achieve reductions from capped sectors consistent with the regional reduction goal with modest economic benefits. The cost per metric ton of allowances is expected to remain below $25 through 2020 with complementary policies, banking, and offsets. WCI's economic modeling found that the savings from reduced fuel expenditures under a cap-and-trade program with complementary policies could exceed the cost of additional investments in energy efficiency. The overall effect on the economy (e.g., the effect of the WCI program on state GDP, employment, and income) remains to be analyzed via additional macroeconomic modeling; however, prior modeling studies of other proposed cap-and-trade programs found that the economy can continue to grow robustly under well-designed climate policies.

1.8. Allowance Apportionment to WCI Partners

1.8.1. Definition

Allowance apportionment describes the individual Partner share of the overall "budget" of GHG emission allowances under a regional cap. An allowance budget must be set for each Partner jurisdiction.

1.8.2. Design Recommendation

The WCI Partner jurisdictions are recommending the following concerning the establishment of individual WCI Partner allowance budgets:[22]

- Each WCI Partner will have an annual allowance budget within the regional cap. All annual allowance budgets through 2020 will be established before the start of the program in 2012. The sum of the individual Partner's allowance budgets will equal the regional cap.

[22] The Allocation Options paper describes the advantages and disadvantages of different allocation options and the relevant design principles. Available at http://www.westernclimateinitiative.org/ewebeditpro/items/O104F14628.pdf.

- Each WCI Partner's 2012 allowance budget will be based on the best estimate of expected emissions for sources covered in the cap-and-trade program in the WCI Partner's jurisdiction in 2012, developed using the best available data and by accounting for expected changes in emissions in 2012. Population growth, economic growth, voluntary and mandatory emissions reductions, and other factors will be considered. Of particular importance is that the voluntary emission reductions recognized through the issuance of Early Reduction Allowances be reflected in the estimates for the 2012 allowance budgets. A mechanism is needed, and will be developed, that reconciles the 2012 allowance budgets for each Partner with the Early Reduction Allowances issued by each Partner.
- There will be a one-time adjustment in 2012 to each WCI Partner jurisdiction's allowance budget to account for the production and consumption of electricity megawatt hours within each WCI Partner jurisdiction, population growth, and the share of total WCI Partner jurisdictions emissions in 2001 through 2005. Each WCI Partner jurisdiction will make a one-time contribution of one percent of its 2012 budget to make these adjustments.
- For 2015, each WCI Partner jurisdiction's allowance budget will be set by adding the best estimate of expected actual emissions in 2015 from transportation, residential, and commercial fuels, and small industrial fuel users (and any other sectors or sources that may be added to the program for the first time in 2015) to the emissions trajectory for the sources first included in the program in 2012. The estimate of expected actual emissions in 2015 will be developed using the best available data (including available mandatory reporting data) and by accounting for expected changes in emissions in 2015 for the sources added to the cap at that time. Population growth, economic growth, voluntary and mandatory emissions reductions, and other factors will be considered in making the estimate.
- Each WCI Partner jurisdiction's 2020 allowance budget will be derived from its individual WCI Partner jurisdiction goal used for purposes of the program.[23] Reductions from other greenhouse gas reduction policies will also be considered.
- In order to avoid the double counting of emissions associated with electricity that is generated in one WCI Partner jurisdiction but consumed in another Partner jurisdiction, the affected WCI Partner jurisdictions will negotiate an equitable solution for apportioning those allowances.
- For years post-2020, the WCI Partner jurisdictions will set allowance budgets not less than three years in advance, based on future reduction limits or goals and using at least three years of reporting data for covered sectors.
- Individual WCI Partner jurisdiction allowance budgets will be established before the start of the program in 2012 and will only be adjusted for changes in WCI membership, changes in program scope or applicability thresholds, or to correct for errors discovered in the data.

[23] Partner goals are those reduction goals or limits that have been established by each individual WCI Partner jurisdiction for the cap-and-trade program.

1.8.3. Stakeholder Input

Stakeholders provided a wide diversity of comments on potential ways to apportion allowances among Partners, with little consensus on key issues particularly for the electricity sector. Many argued for emissions to be apportioned based on load while others were equally passionate that emissions be apportioned based on historical emission levels. The comments reflected the stakeholders' view of how the apportionment method selected might affect their potential to receive free allocation.

Several stakeholders called for WCI to recognize the voluntary market for Renewable Energy Credits (RECs) via a set-aside of allowances to reward or incentivize renewable investment at the regional or state and provincial level.

1.8.4. Discussion of the WCI Partners' Recommendation

The WCI Partners' recommendation for the establishment of individual WCI Partner jurisdiction allowance budgets reflects the special or unique circumstances in each state and province, including the mix of industries; the production and consumption of electricity and the source of that electricity; and expected growth in the economy and population. The WCI Partner jurisdictions agreed to make a one-time adjustment to take these factors into account. The formula for determining how to distribute the allowances associated with this adjustment will be part of the work plan for 2009 and beyond for the WCI Partner jurisdictions.

Nothing in this design precludes any individual WCI Partner jurisdiction from setting aside some amount of allowances to reward or incentive renewable energy. See Part 1.10 for the discussion on set-asides.

1.9. Allowance Distribution by Partners

1.9.1. Definition

Allowance distribution is the Partners' initial issuance of GHG emission allowances.

1.9.2. Design Recommendation

The WCI Partner jurisdictions are proposing the following approach to allowance distribution by the WCI Partners:[24]

[24] The Allocation Options paper describes the advantages and disadvantages of different allocation options and the relevant design principles. Available at http://www.westernclimateinitiative.org/ewebeditpro/items/O104F14628.pdf.

- Generally, allowance distribution will be done independently by each WCI Partner jurisdiction.
- In some cases, the WCI Partner jurisdictions have agreed to consider standardizing allowance distribution across specific sectors if analysis demonstrates uniform treatment is necessary to address competitiveness issues. This uniform treatment, if deemed necessary, will be implemented prior to the first compliance period.
- The WCI Partner jurisdictions have agreed that a portion of the *value* represented by each Partner's allowance budget (for example, through set-asides of allowances, a distribution of revenues from the auctioning of allowances, or other means) be dedicated to specific purposes that will benefit all of the WCI Partner jurisdictions. Those purposes are: energy efficiency; research, development, demonstrations, and deployment (RDD&D); agricultural and forestry sequestration; and adaptation to climate change impacts.
- The WCI Partner jurisdictions are recommending a number of other potential uses for the remaining allowance value. They are: reducing consumer impacts, especially for low-income consumers; providing for worker transition and green jobs; achieving emission reductions in communities that experience disproportionate environmental impacts; supporting community-wide efforts funded by local governments to reduce GHG emissions; providing transition assistance to industries; recognizing early actions to reduce emissions; and/or promoting economic efficiency.
- For the first compliance period, the WCI Partner jurisdictions will auction a *minimum* of 10 percent of the allowance budget, and to increase the minimum percentage to reach 25 percent in 2020. WCI aspires to reach higher auction percentages over time, possibly to 100 percent.
- Each WCI Partner jurisdiction may auction a greater percentage of its allowance budget at its discretion.
- Some jurisdictions may not have the legal authority to auction allowances and that will not prevent the other Partner jurisdictions with authority from doing so.
- Each WCI Partner will advise the other WCI Partners of its allocation methods before the program start, and at least one year in advance of the start of each subsequent compliance period.
- The WCI Partner jurisdictions have recommended that auctioning be coordinated through a regional auction platform. The design of the auction will be completed before the cap-and-trade program begins in 2012 and will consider how to prevent market manipulation under the auctions.
- To counter any potential oversupply of allowances in the emissions trading market, the WCI Partner jurisdictions recommend that the first five percent of the allowances auctioned during the first and second compliance period have a reserve price. Should some of the allowances not sell at the reserve price, the Partners may retire a fraction of the allowances or retain them to be auctioned in later compliance periods, as agreed to by the WCI Partners in advance.

1.9.3. Stakeholder Input

There were widely differing opinions about how the Partners should distribute allowances. Some commenters called for 100 percent free allocation to covered facilities and entities, while others favored a 100 percent auction of all allowances. Still others favored a hybrid with some distribution for free, such as to retail providers of electricity with the rest auctioned. Most stakeholders who advocated for 100 percent auction pointed to the Regional Greenhouse Gas Initiative (RGGI), which ultimately decided to auction nearly 100 percent of the allowances in that system. They expressed concern over the creation of windfall profits from the distribution of free allowances to covered facilities and entities. Some stakeholders asked that the approach for distributing allowances take into account competitiveness issues that may arise between similar industries and between industrial sectors under the cap-and-trade program. No common ground was found in the widely varying stakeholder views. A number of stakeholders commented on the use of auction revenue. A variety of uses and purposes were suggested.

1.9.4. Discussion of the WCI Partners' Recommendation

In making their recommendation on allowance distribution, the WCI Partners considered the following:

- Auctions are an efficient methodology to distribute allowances and some level of auction is necessary for price discovery, which may help to minimize price volatility, especially in the beginning of the program.
- The WCI Partner jurisdictions aspire to eventually achieve a nearly 100 percent level of auction.
- Unlike RGGI, which covers just the electricity sector in the Northeast and is a deregulated market, within the WCI most of the electric sector is vertically integrated and rate regulated. Auctions are not needed to address potential windfalls under these conditions, and the allowances that are provided will be used for public purposes.
- Like RGGI, the WCI Partners believe that the decision on the maximum amount of auctioned allowances is best left to that states and provinces. The RGGI states agreed to use a percentage of the value of the allowances for consumer benefit and strategic energy purposes. The decision to auction allowances was made by each participating state after consultation with stakeholders and legislators in part as the method to assure those uses were realized. The WCI Partner jurisdictions have recommended that the allowance value be used for purposes similar to RGGI. The allowance value could be from auction revenues, direct allocation of allowances for specific uses, through set-asides, or other means as determined by the individual states and provinces.

- In addition to electricity, the first compliance period covers industrial emission sources. Many industrial facilities face domestic and international competition from facilities that are not covered by climate policies. For those facilities that are unable to pass along compliance costs in the face of this competition, there is a substantial risk of emissions leakage: the emissions would shift to outside of the WCI Partner jurisdictions without reducing emissions overall. The related issue of job leakage or outsourcing, even to other parts of the United States or Canada, is a legitimate concern that needs to be considered by each state and province. As a regional program, the primary mechanism for addressing this leakage risk is through the judicious distribution of allowances to facilities to ensure that they have an incentive to reduce emissions, but are not disadvantaged competitively.
- If the WCI Partner jurisdictions had designed a federal program for either the US or Canada, the auction percentage would have been much higher because of the guaranteed national scope of the program and the additional policy levers available at the federal level, including the ability to address international competition.
- There is uncertainty regarding the status of future international climate agreements and which countries might be signatories to them, particularly China and India. Depending on the outcome, the portion auctioned in a federal program could be higher as the leakage issues are addressed through those international agreements.
- The WCI economic modeling found that combining cap-and-trade with a portfolio of complementary policies will make the program more cost-effective. Using some portion of allowance value for the uses recommended in the WCI design will help realize that cost-effectiveness.[25]

1.10. Early Reduction Allowances and Other Early Actions or Set-Asides

1.10.1. Definition

Early Reduction Allowances refers to rewarding certain greenhouse gas reductions that occur at facilities or entities covered by the cap-and-trade program prior to the start of the program and after a set starting date. *Early actions* refer more generally to activity that reduces emissions that may not qualify for Early Reduction Allowances. *Set-asides* are allowances that are allocated for specific purposes by individual WCI Partner jurisdictions.

1.10.2. Design Recommendation

The program will encourage entities and facilities included under the cap to reduce greenhouse gas emissions after January 1, 2008 and before the start of the first compliance period in 2012 through the issuance of Early Reduction Allowances. These allowances will be in addition to the WCI Partner jurisdictions' 2012 allowance budgets. By the end of

[25] This will recognize pre-existing commitments to action and legislative requirements on use of revenue (e.g., through BC's Climate Action Plan and Carbon Tax).

2009, the WCI Partner jurisdictions will jointly establish criteria to determine which early reductions will be eligible for these allowances. The criteria will ensure that the reductions are voluntary, additional/surplus, real, verifiable, permanent, and enforceable. Each WCI Partner jurisdiction that issues Early Reduction Allowances will do so in 2012. These Early Reduction Allowances will be treated like other allowances in the cap-and-trade program.

For all other early actions and all types of set-asides, each WCI Partner jurisdiction will have the discretion to determine which early actions it will recognize or whether and for what purposes allowances will be set-aside. Recognition for early action and other set-asides will come from within the cap and out of the individual WCI Partner jurisdiction's allowance budget.

1.10.3. Stakeholder Input

There was a general level of support for granting recognition for early actions through the award of allowances. Some commenters favored awarding those allowances through set-asides coming out of individual WCI Partner allowance budgets. However, most commenters preferred that allowances be issued in addition to each WCI Partner's allowance budget as the only meaningful way to recognize GHG emission reductions that are taken prior to program launch.

1.10.4. Discussion of WCI Partners' Recommendation

The recommendation allows for the award of Early Reduction Allowances to facilities and entities that will be covered by the program that reduce their emissions on or after January 1, 2008 and before January 1, 2012. The WCI Partner jurisdictions will develop the additional criteria for determining which reduction activities will be eligible for Early Reduction Allowances. All Early Reduction Allowances will be allocated to the facilities and entities that have made reductions that are eligible for these allowances in 2012 only. Entities that will be covered by the program in 2015 may be eligible for these allowances and will also receive them in 2012.

The WCI Partner jurisdictions believe that the granting of Early Reduction Allowances provides an additional incentive for facilities and entities that will be covered by the cap-and-trade program to reduce emissions prior to the program start. Awarding these allowances will not result in an over-allocation of allowances because the Early Reduction Allowances will apply to reductions of emissions that would have otherwise been included in each Partner's 2012 allowance budget. This design recommendation is consistent with the Northeast NO_x Budget Cap-and-Trade Program, as well as the subsequent U.S. Environmental Protection Agency (EPA) NO_x SIP-Call Program.

The WCI Partner jurisdictions also recognize that there are specific purposes for which allowance set-asides may be warranted. For example, a WCI Partner jurisdiction with hydro power may want to set-aside allowances for use during low water years. Alternatively, a WCI Partner jurisdiction may want to recognize early reduction activities that do not qualify

for Early Reduction Allowances. Each Partner will have the discretion to create set-asides for specific purposes; any allowances used for these purposes will come from the Partner's allowance budget.

1.11. Banking, Borrowing and Compliance Periods

1.11.1. Definitions

Banking of emissions allowances and offset credits means that holders of the allowance or offset credit may use the allowance or credit that is received or purchased in one compliance period for sale or use in a subsequent compliance period. *Borrowing* means using allowances from a future compliance period to cover a compliance obligation in a current compliance period.

1.11.2. Design Recommendation

Emission allowances will not expire. Parties who own emission allowances will be allowed to hold, or "bank," the allowances without limitation, except to the extent that restrictions on the number of allowances any one party may hold are necessary to prevent market manipulation.

Borrowing of allowances will not be permitted.

Each compliance period will cover three specific years: 2012–2014 is the first compliance period; 2015–2017 is the second compliance period, and 2018–2020 is the third compliance period. The compliance periods will not be rolling periods. Each will start on January 1 of the first year of the compliance period.

1.11.3. Stakeholder Input

Stakeholders who commented on these issues generally favored allowing unlimited banking of allowances. Some commenters expressed concern that extensive banking could lead to manipulation of the market. Borrowing attracted some favorable comments, but also a number of negative comments. Nearly all commenters favored a multi-year compliance period.

1.11.4. Discussion of WCI Partners' Recommendation

Banking of allowances can encourage early compliance. Banking of allowances can reduce volatility over time by providing liquidity in the market. It can also give facilities and entities a stake in the continued operation of the program in that banked allowances are a financial asset. In the economic analysis conducted for the WCI program design, banking moderated allowance prices more than any other program design element, including offsets, thereby reducing the costs of the program. Banking has been used in the U.S. Acid Rain

cap-and-trade program, as well as the NO_x budget trading program in the Eastern United States.

The WCI Partner jurisdictions have recommended that banking of allowances be allowed without limit, except to the extent that limits on banking prove necessary to prevent market manipulation. This is an issue that the WCI Partner jurisdictions will analyze prior to the start of the program.

Borrowing of allowances will not be allowed in the WCI cap-and-trade program. Borrowing creates a risk of undermining the program because the practice creates a debt, and could result in facilities and entities with a large debt asking for relief. Such relief may result in an over-allocation of allowances, a breaking of the emissions cap or exemptions from the program's coverage. No U.S. cap-and-trade system to date has allowed borrowing.

The three-year compliance period will allow covered facilities and entities to manage planned or emergency changes in operations over the short term, as well as low water years that might affect the generation of hydro electricity.

1.12. Offsets and Allowances from Other Cap-and-Trade Systems

1.12.1. Definition

Offsets are GHG emission reductions, GHG emissions avoided, or GHG removals from the atmosphere, measured in metric tons of CO_2e. Offsets are achieved by *offset projects*. *Offset credits* (also measured in metric tons of CO_2e) are issued for offsets that are achieved by offset projects that meet certain criteria. Offset credits can be traded, and can be used for compliance purposes, or as part of voluntary actions. When used within a cap-and-trade program, offset credits used for compliance purposes come from emission sources or sinks not covered by the cap.

Emission allowances from other cap-and-trade systems are regulatory instruments used to limit GHG emissions. These emission allowances are issued by appropriate government regulatory authorities and are used for compliance purposes.

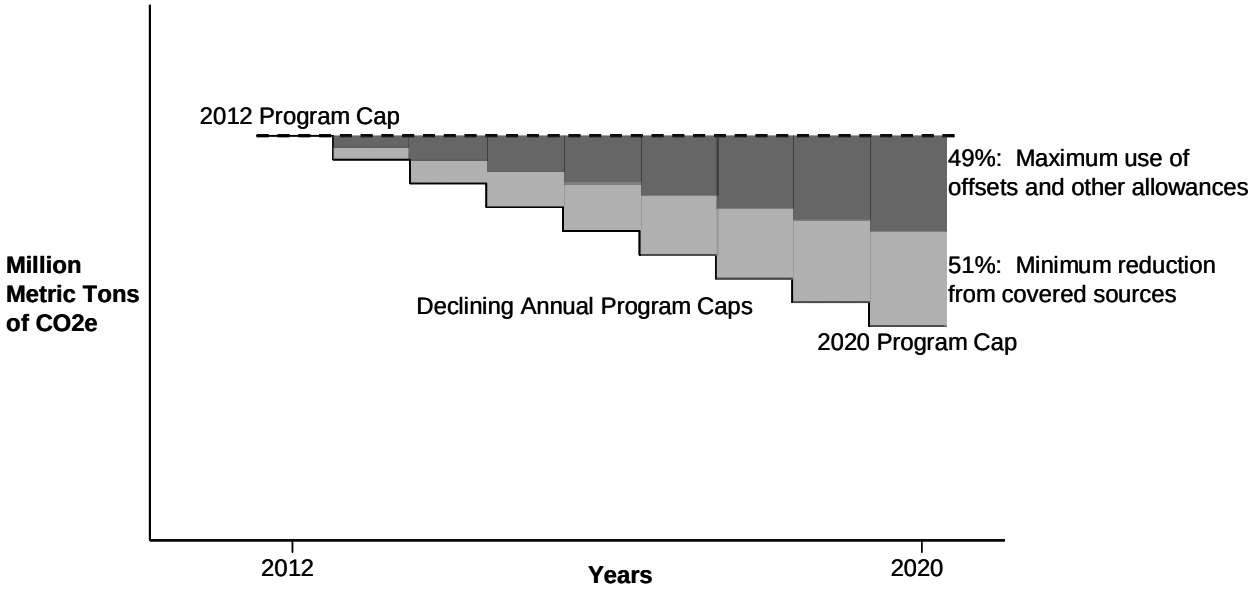
1.12.2. Design Recommendation

The WCI Partners are recommending a rigorous offset program. The purpose of the offset program is to reduce compliance costs while encouraging emission reductions, innovation, and technology development for sources and sinks not covered by the cap-and-trade program. In order to achieve these goals, the WCI Partners recommend the following offset program design features:[26]

[26] The Offsets Options Paper describes how, in developing its recommendation, the Offsets subcommittee defined a range of options, including whether to have offsets, and whether to limit their quantity, location, and type. Available at http://www.westernclimateinitiative.org/ewebeditpro/items/O104F14585.PDF . WCI

- The WCI Partner jurisdictions will establish standards and processes for issuing offset credits, accepting offset credits from the Clean Development Mechanism (CDM), and recognizing emission allowances from other GHG trading systems. The offset credits issued or recognized by the WCI Partner jurisdictions and emission allowances from other GHG trading systems recognized by the WCI Partner jurisdictions can be used for compliance purposes in the WCI Partner jurisdictions cap-and-trade program. The standards and processes will be developed and implemented in an open and transparent manner that will be well-defined in advance of the start of the cap-and-trade program.
- The WCI Partner jurisdiction will limit the use of all offsets and allowances from other GHG emission trading systems that are recognized by the WCI Partner jurisdictions to no more than 49 percent of the total emission reductions from 2012-2020. This limit will ensure that a majority of emission reductions occur at WCI covered entities and facilities. The 49 percent limit is conceptually illustrated in Figure A.

Figure A: Illustration of the 49 Percent Offsets Limit



This illustration shows how the limit on the use of all offsets and allowances from other systems is limited to 49 percent of total emission reductions starting from the 2012 program emissions cap. For simplicity, this illustration does not show the expansion of the program scope in 2015.

held an Offsets Public Workshop to help inform its recommendation. Workshop materials are available at http://www.westernclimateinitiative.org/WCI_Meetings_Events.cfm . The Offsets subcommittee defined criteria and objectives for the offsets program. See the Offsets Draft Design Recommendations for details. Available at http://www.westernclimateinitiative.org/ewebeditpro/items/O104F16589.PDF

- Each WCI Partner jurisdiction will have the discretion to set a lower limit on the use of offsets and allowances from other trading systems.
- The WCI Partner jurisdictions will jointly establish criteria to ensure that all offset projects used to meet a compliance obligation result in a GHG reduction, removal or avoidance that is real, surplus/additional, verifiable and permanent. The criteria will be used to ensure that the quantification of the GHG reduction, removal, or avoidance is accurate and not double counted.
- In addition, offset projects must be enforceable by the individual WCI Partner jurisdiction that is issuing the credit and the credit must be verifiable by the individual WCI Partner jurisdiction that is accepting it.
- The standards and processes for approving offset projects will be developed and implemented in an open and transparent manner that will be well-defined in advance of the start of the cap-and-trade program.
- Offset credits will not be approved for projects that reduce, remove or avoid emissions from sources covered by the WCI cap-and-trade program.
- The WCI Partner jurisdictions have identified the following list of project types as a priority for investigation and potential participation in the offset program:
    - Agriculture (soil sequestration and manure management);
    - Forestry (afforestation/reforestation, forest management, forest preservation/conservation, forest products); and
    - Waste management (landfill gas and wastewater management).
- Starting in 2009, the WCI Partner jurisdictions will jointly coordinate to review, develop and approve protocols for the project types that meet the necessary criteria for inclusion. At the same time, WCI Partner jurisdictions will initiate the establishment of a process to coordinate the review and approval of other project types and protocols proposed by project developers.
- WCI Partner jurisdictions will recognize offsets meeting the WCI criteria within their own jurisdictions regardless of which WCI Partner jurisdiction issued them. Offsets not meeting the WCI criteria will not be accepted for compliance purposes.
- The WCI Partner jurisdictions are recommending the following geographical parameters for offsets:
    - WCI Partner jurisdictions may approve, certify, and issue offset credits for projects located throughout the United States, Canada, and Mexico where such projects are subject to comparably rigorous oversight, validation, verification and enforcement as those located within the WCI jurisdictions.
    - WCI Partner jurisdictions will not accept offset credits for GHG reductions in developed countries (Annex 1 countries in the UN Framework Convention on Climate Change) for projects that reduce, remove, or avoid emissions from sources that within WCI Partner jurisdictions are covered by the cap-and-trade program.

- The WCI Partner jurisdictions may accept offset credits from developing countries through, for example, the Clean Development Mechanism (CDM) mechanism of the Kyoto Protocol, and the WCI Partner jurisdictions may establish added criteria to ensure similar rigor to WCI approved/certified offset projects or other requirements appropriate to enable use of these offset credits in the cap-and-trade program.
- The WCI Partner jurisdictions encourage the development of offset projects located inside WCI Partner jurisdictions for compliance purposes in the WCI cap-and-trade regulatory program in order to capture collateral benefits associated with some offsets projects, such as health, social, and environmental benefits.

1.12.3. Stakeholder Input

Stakeholders generally supported a rigorous offset program. Underlying the support for an offset program is the recognition that all offsets used for compliance purposes must be of the highest quality. Stakeholders referenced issues that have arisen in previous offset programs, including the CDM, to highlight the importance of developing and applying project protocols that ensure that reductions are real, surplus/additional, verifiable, permanent, and enforceable.

Stakeholders were divided on whether the use of offsets for compliance purposes should be limited either in quantity or location. Some stakeholders suggested that there is no need to limit the use of high quality offsets because they reflect real emission reductions. Some stakeholders objected to the use of any offsets, pointing out the existing disproportionate environmental impacts experienced in some communities. Many stakeholders expressed a strong preference for a limitation on the use of offsets to ensure that a majority of reductions are made at covered facilities or entities. Many others favored no limitation provided the offsets meet rigorous criteria.

Many stakeholders expressed support for specific types of offsets. Many stakeholders also commented that the offset limitation should be applied to the reductions that are required, not to the compliance obligation of a facility or entity. Finally, some stakeholders recommended that the location of offset projects be limited to within WCI partner jurisdictions in order to assure enforcement and verification or so that the environmental co-benefits of the projects would be realized within the WCI jurisdictions. Others argued that any reduction in greenhouse gases in the world is important to combat climate change and thus the location of the project should not matter.

1.12.4. Discussion of WCI Partners' Recommendation

The WCI Partners believe that the program as designed will result in a rigorous offset program. The Partners recognize that issues have been raised regarding the quality of offsets from previous programs and the Partners propose to learn from past efforts, to build

on their strengths and avoid their weaknesses. Toward this end, the Partners will develop and implement the offset program in an open and transparent manner that incorporates stakeholder input and involvement.

In making the recommendations in the program design, the WCI Partner jurisdictions considered the following:

- Offsets are an important tool to manage the risks of unexpectedly high compliance costs. Multiple analyses, including the economic analysis conducted for the WCI Partner jurisdictions, highlight the role that offsets can play in reducing the risks of high compliance costs.
- The quality of the offset project matters. It must be real, additional/surplus, permanent, verifiable, and enforceable.
- The criteria and protocols for offsets are critically important and will be developed by the WCI partner jurisdictions jointly.
- The manner in which greenhouse gases, especially carbon dioxide, mix in the atmosphere means that a reduction in any location is important to address global climate change.
- The wording of the Initiative signed by the Governors and Premiers calls for a design of a market program that will reduce greenhouse gases in the WCI Partner jurisdictions collectively "and to achieve related co-benefits."
- Co-benefits include the innovation that comes from moving toward a low carbon economy, which the cap incentivizes.
- The majority of emission reductions - at least 51 percent - will come from facilities and entities covered by the WCI program. This will help initiate the transformation to a low- carbon future within the WCI jurisdictions.
- Any WCI Partner jurisdiction that sets a limit lower than 49 percent will reduce the use of offsets and allowances from other systems from its portion of the total.
- Offset projects in developed countries (including Canada and the United States) that reduce emissions from sources that would be covered by the cap-and-trade program were they in the WCI Partner jurisdictions are not eligible to create offset credits. The WCI Partners have excluded offset credits from these projects in developed countries to avoid providing an incentive to delay the adoption of policies to reduce GHG emissions.
- Offset projects located outside the WCI jurisdictions that are subject to comparably rigorous oversight, validation, verification, and enforcement as those located within the WCI jurisdictions should help reduce compliance costs.
- The WCI Partner jurisdictions recognize that flexibility to use the limited amount of offsets and allowances from other systems any time throughout the period of 2012-2020 may help contain compliance costs. Therefore, the offset program may

incorporate flexibility to use offsets and non-WCI allowances across the three compliance periods, which each WCI Partner jurisdiction could use at its discretion.

- The WCI economic modeling analysis found that offsets contribute to managing the risk of high compliance costs in combination with banking and complementary policies. However, the analysis indicated that limiting the use of offsets and allowances from other programs to 49 percent of the reductions achieved by the program should provide adequate cost moderation.

The WCI Partner jurisdictions will establish eligible WCI offset project types, as well as requirements, methodologies and measurement and verification protocols, in advance of the program start. This approach will help ensure that project developers clearly understand the requirements for achieving acceptable reductions before the project begins. The WCI Partner jurisdictions will also develop a process by which offset project developers can propose additional offset project types for approval.

The WCI Partners did not include a recommendation to limit offset projects to WCI Partner jurisdictions in order to provide opportunities for additional low-cost reductions within the system, to support emission reductions on a global scale, and because of concerns that such a limitation may not withstand legal challenges.

1.13. Cost Containment

1.13.1. Definition

Cost containment is keeping the costs of program as low as possible, consistent with program objectives. There are a variety of cost containment mechanisms that can help manage the cost of compliance for covered entities in a cap-and-trade program. The cap-and-trade program is itself a form of cost containment, since emission trading minimizes costs. Offsets, described above, are a cost containment mechanism. Temporal flexibility, including banking, borrowing, and the length of the compliance period, is another.

1.13.2. Design Recommendation

The WCI Partner jurisdictions are recommending a broad scope and the inclusion of offsets as described above. They also recommend that purchasers and covered entities be allowed to bank allowances, without restrictions on the amount of allowances that may be banked or on how long they may be banked. WCI Partner jurisdictions recommend that borrowing of allowances from future compliance periods not be allowed. The WCI Partners recommend the compliance periods be three years long.

1.13.3. Stakeholder Input

Stakeholder input generally favored the inclusion of the cost-containment features of a broad cap-and-trade program, some offsets component, and unlimited banking. Stakeholder comment generally did not favor borrowing. In addition, some stakeholders called for an emergency clause, allowance price cap, or exit ramp in the event of a significant economic crisis attributable to the cap-and-trade program.

1.13.4. Discussion of WCI Partners' Recommendation

The WCI Partner jurisdictions have made a number of design decisions that will contain costs.

- The broad scope affords numerous opportunities to contain costs through emission trading.
- Temporal flexibility allows firms greater flexibility in compliance. Such flexibility can reduce allowance price volatility.
- Unlimited banking will help address price volatility.
- Complementary programs will also contain costs, and the program encourages their use.
- Offsets will also help contain costs.

The WCI Partner jurisdictions did not include borrowing for the reasons noted in Part 1.11. An allowance price cap was also not included because of the potential to exceed the cap and not meet the emission goal in 2020. The WCI Partners hope to link this program to other similarly rigorous programs, possibly including the EU ETS. It is the understanding of the WCI Partner jurisdictions that the EU will not link to a system with a price cap. Finally, the WCI Partner jurisdictions did not include an escape clause because each WCI Partner jurisdiction has its own laws on emergency action that must be considered in the development of any such recommendation.

1.14. Reporting

1.14.1. Definition

Reporting describes the required monitoring and measurement of GHG emissions by facilities and entities, and how these emissions will be reported.

1.14.2. Design Recommendation

The WCI Partner jurisdictions recommend that mandatory measurement and monitoring for the six included GHGs commence January 2010 with reporting of the 2010 calendar year emissions beginning in early 2011. The entities and facilities subject to reporting are those with annual emissions equal to or greater than 10,000 metric tons of CO_2e. Where fuel

combustion emissions are covered upstream (e.g., emissions from transportation fuel combustion and emissions from fuel combustion at residential, commercial, and industrial facilities with emissions below the threshold) the reporting threshold will apply to entities (e.g., fuel distributors and blenders) based on the expected combustion emissions from the fuels distributed. However, in some limited instances the threshold may be based on other parameters, such as throughput or capacity, as long as these thresholds represent the equivalent of, or are lower than, the 10,000-metric-ton threshold.

WCI Partner jurisdictions will require third-party verification of reported emissions from entities and facilities that will be included under the cap.

Prior to the start of the mandatory reporting program, the WCI Partner jurisdictions will establish the essential requirements for reporting by all entities and facilities required to report in each of the WCI Partner jurisdictions. Essential requirements will include specifics regarding:

- Applicability and Boundaries
- Definitions
- Timing
- Report Content and Submittal
- Pollutants and Equivalence Factors
- Compliance
- Verification/Audit/Quality Assurance
- Emissions Quantification and Monitoring

As each WCI Partner jurisdiction collects additional emissions data from entities and facilities required to report, certain data will be made available to all WCI Partner jurisdictions for review and consideration for possible expansion of the cap-and-trade program.

Each WCI Partner jurisdiction will maintain discretion to require reporting at lower thresholds or from entities and facilities outside of the cap-and-trade program.

1.14.3. Stakeholder Input

Stakeholders said they want a reporting system that is fair, easy to manage, and not costly for reporters or WCI Partner jurisdictions. Stakeholders generally supported a transparent and robust accounting system for consistent and accurate reporting of emissions across sectors and jurisdictions. There was substantial support for the WCI Partner jurisdictions' efforts to harmonize WCI reporting and future federal greenhouse gas reporting, and there was concern regarding the burdens of having to report differently to multiple programs. Stakeholders overwhelmingly supported beginning reporting before cap-and-trade commences, in order to have accurately measured emissions as a basis for allocating allowances. Stakeholders were generally split on the topic of third-party verification.

Additional opportunities for stakeholder input will be available during the fall of 2008 as the essential requirements for reporting continue to be developed and the final draft is released in December of 2008.

1.14.4. Discussion of WCI Partners' Recommendations

Comprehensive mandatory and accurate reporting is especially important to a cap-and-trade program because of its focus on actual emissions performance and emission allowance trading. The WCI Partner jurisdictions' recommendations are consistent with the overwhelming stakeholder support for beginning reporting before cap-and-trade commences, and with the general support for the development of uniform WCI-wide reporting rules to maximize administrative simplicity and cost effectiveness.

The WCI Partners recognize the burdens that would be created by multiple widely divergent reporting programs, and will seek to harmonize reporting across WCI Partner jurisdictions. The WCI Partner jurisdictions will encourage federal reporting program development to consider the need for flexibility and accommodation of the needs of regional cap-and-trade programs already far along in their development.

The WCI Partner jurisdictions recommend a reporting threshold lower than the threshold for inclusion in the cap-and-trade program for several reasons. First, reporting must be at a lower level to ensure that accurate, verified emissions data support the exclusion of a sub-threshold entity or facility from the obligation to hold allowances. Second, reporting down to a threshold of 10,000 metric tons of CO_2e is needed to determine whether the threshold for inclusion in the cap-and-trade program is set at the appropriate level to include a high proportion of emissions. Third the lower reporting threshold is required to monitor potential leakage to facilities or entities below the threshold of the cap-and-trade program. Finally, a threshold of 10,000 metric tons of CO_2e is being considered in potential legislation for a U.S. federal cap-and-trade program.

The WCI Partner jurisdictions have considered the advantages and disadvantages of third-party verification and jurisdictional audit and quality assurance. The WCI Partner jurisdictions note that in a cap-and-trade program, every metric ton of emissions translates into a financial obligation or benefit, whereas in existing air pollutant reporting and compliance, errors in emissions data can be inconsequential if they do not affect whether a compliance limit has been exceeded. For those facilities and entities with compliance obligations, there are no inconsequential emissions totals. A high degree of accuracy and reliability for this emissions data is needed for market transparency and credibility, as well as for potential linkage to other emissions trading programs.

1.15. Enforcement

1.15.1. Definition

Enforcement is the means of assuring covered entities' compliance with the cap-and-trade program.

1.15.2. Design Recommendation

The WCI Partner jurisdictions recommend that if a covered entity or facility does not have sufficient allowances at the end of a compliance period, the entity or facility shall be required to surrender three allowances for every excess metric ton of CO2e to the jurisdiction to which they have the compliance obligation within three months of the end of each compliance period. This does not preclude other penalties allowed under individual state or provincial laws. Each WCI Partner jurisdiction will retain its existing regulatory and enforcement authority and responsibilities.

1.15.3. Stakeholder Input

Stakeholders generally recognized the importance of having an enforcement mechanism. A number of stakeholders noted a preference for financial penalties or a combined policy that calls for a violator to surrender required allowances and pay a fine. Additionally, some stakeholders requested greater flexibility during the first compliance period while regulated sources become familiar with the program. Stakeholders also highlighted the importance of transparency in the enforcement process, specifically recommending that information be made public regarding the use and origin of offset credits for compliance.

1.15.4. Discussion of WCI Partners' Recommendation

In any cap-and-trade program, participants must be accountable for their emissions and must comply with requirements for monitoring, reporting, and holding adequate emissions allowances. The enforcing jurisdiction must provide certainty through well-recognized and automatic penalties for non-compliance. Previous well-designed cap-and-trade programs have had compliance rates over 99 percent. [27]

The enforcement mechanism recommended by the WCI Partner jurisdictions is the same as the NO_x Budget Program in the northeastern United States. The Partners did not recommend a financial penalty because the price of allowances will be set by the market. It will be impossible to assure a set penalty amount will be higher than the cost of allowances.

[27] Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California, available online at http://climatechange.ca.gov/publications/market_advisory_committee/2007-06-29_MAC_FINAL_REPORT.PDF.

However, each WCI Partner jurisdiction may establish additional penalties, including civil and criminal penalties for intentional violations of program requirements. Such penalties provide an additional level of deterrence to ensure that the financial incentives associated with the cap-and-trade program are not abused and to increase confidence in the integrity of the market and the value of an allowance.

The WCI Partner jurisdictions also recommend that certain data from the emissions reports, allowances, and offsets that are used for compliance be made public in a timely manner to ensure transparency and maintain public confidence.

1.16. Regional Organization

1.16.1. Definition

A *regional organization* centralizes the execution of administrative tasks for the WCI Partner jurisdictions. It has no authority beyond that of the individual WCI Partner jurisdictions.

1.16.2. Design Recommendation

The WCI Partner jurisdictions will create a regional administrative organization to:

- Coordinate the regional auction of allowances;
- Track emissions and provide public information on progress towards the WCI regional goal;
- Monitor and report on market activity, including any potential market manipulation;
- Serve as a forum for WCI Partners to update one another on program progress;
- Coordinate review and adoption of protocols for offsets;
- Coordinate review and adoption of updated reporting requirements and emissions measurement methods;
- Coordinate review and issuance of offset credits; and
- Suggest criteria and means to accredit service providers to deliver validation and verification services.

1.16.3. Stakeholder Input

Stakeholders generally emphasized the need for coordination across the region to ensure consistency in the program.

1.16.4. Discussion of WCI Partners' Recommendation

The regional organization recommendation is designed to help the WCI Partner jurisdictions achieve the necessary coordination. Each jurisdiction will retain its regulatory authority and enforcement responsibilities. By centralizing administrative tasks and coordinating WCI Partner activities, the regional organization will help reduce administrative costs and

improve program transparency and consistency. RGGI has such an organization and it has thus far been successful in facilitating consistent implementation of RGGI's cap-and-trade program across the RGGI states.

1.17. Other Issues Raised by Stakeholders

A few stakeholders have also raised issues around market manipulation. The WCI Partners will continue to examine this issue and are committed to taking steps as the program is further designed to minimize the potential for manipulation. Evidence from existing and past allowance systems has not revealed compelling evidence that market manipulation through collusion or other market gaming situations has occurred. Price distortions did occur where there was not full price disclosure or when trading was thin, causing price volatility.

2. Overview of Cap-and-Trade

A cap-and-trade program sets a clear, mandatory, enforceable limit on GHG emissions and then allows the market to identify the least-cost ways to achieve the limit. The state or provincial government sets an absolute aggregate limit (or "cap") on GHG emissions from a sector or multiple sectors. Tradable emissions "allowances," or limited authorizations to emit,[28] are then distributed in an amount that equals the total emissions permitted by the cap, which may decline over time. These allowances can be distributed by auction, free allocation, or a combination of the two. The government specifies which entities or facilities must surrender allowances to cover their emissions at the end of a pre-determined period of time, which is called the "compliance period."

After allowances are issued by governments, they can be bought and sold ("traded"). The limit on the total number of allowances, combined with the requirement to surrender allowances to cover emissions, makes allowances valuable and scarce. Allowance trading occurs because participants face different costs for reducing emissions. Trading allowances reveals a market price for them. The price is an incentive to facilities and entities with emissions to either invest in reductions that will let them sell allowances or avoid the cost of buying them. For some participants, implementing new, low-emitting technologies may be relatively inexpensive. Those participants will buy fewer allowances or sell surplus allowances to participants that face higher emission control costs. A participant will choose to buy more allowances when the cost of an allowance is lower than the cost of reducing its emissions. By giving participants a financial incentive to control emissions and the flexibility to determine how and when emissions will be reduced, the capped level of emissions is achieved in a manner that minimizes the cost of emissions reductions.

[28] Emission allowances are not considered property rights but are a limited authorization to emit.

Emissions trading programs have been successfully implemented in the United States and other countries to control other types of emissions, such as acid rain pollutants like sulfur dioxide (SO_2), in an environmentally sound, cost-effective manner.[29]

When designed properly, cap-and-trade programs provide certainty on the level of emissions reductions achieved and help ensure these reductions are attained at the lowest cost. The cap creates a firm limit on GHG emissions. By letting individual sources choose when and how to reduce emissions, cap-and-trade minimizes the cost of emission reduction. It also stimulates the development of new technological solutions that can enable lower-cost reductions now and in the future.

Cap-and-trade programs may also cost governments less to implement than command-and-control programs in which governments specify various performance, operational, or emission requirements based upon technology.[30] The state or province needs only (1) to ensure that covered sources accurately report their emissions and, at the end of each compliance period, surrender a number of allowances equal to their emissions; and (2) to provide some market oversight to ensure fair competition.

When designed properly, cap-and-trade programs can be particularly useful in the effort to address climate change and can aid more traditional policies in achieving emissions reductions. Greenhouse gas emissions come from many different kinds of sources with widely varying options for achieving emission reductions, affording numerous opportunities for mutually advantageous trading. Also, the location of a given emissions reduction does not matter with respect to climate change. A GHG cap-and-trade program is environmentally effective because a ton of carbon dioxide (CO_2) or other greenhouse gas emitted from one source has the same global warming effect as a ton emitted from any other.[31]

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[29] Estimated savings for Phases I and II of the Acid Rain Program were more than $1 billion in 1995 dollars. The cost savings estimated in comparison to command-and-control approaches were estimated to be about 44-55 percent of the total compliance costs. *See for example* Carlson, C. P., D. Burtraw, M. Cropper, and K. L. Palmer. 2000. Sulfur dioxide control by electric utilities. *Journal of Political Economy* 108 (6):1292-1326. Ellerman, A. D., P. L. Joskow, R. Schmalensee, J. Montero, E. M. Bailey. 2000. *Markets for Clean Air: The US Acid Rain Program*. Cambridge: Cambridge University Press.

[30] For example, the U.S. acid rain program requires a staff of approximately 50 people to track all emissions data, allowance transfers, and compliance for over 4000 sources, including auditing of all hourly emissions data, tracking several thousand allowance transfers per year, annual compliance determination, and annual program assessment. See *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*. Recommendations of the Market Advisory Committee to the California Air Resources Board, June 2007, p. 73 and 99. Available online at www.pewclimate.org/docUploads/2007-06-29_MAC_FINAL_REPORT.pdf

[31] From a climate change perspective, because GHGs are chemically stable and persist in the atmosphere for a decade or longer and become well mixed throughout the atmosphere, the location of the reduction does not matter. Still, there may be other important policy reasons to consider the location of GHG reductions.

2.1. The Reasons for a Regional Cap-and-Trade Program

The reasons for coordinating regionally to design and implement a cap-and-trade program are compelling. A vast body of literature makes the case for a GHG cap-and-trade system that maximizes coverage of emissions and minimizes the costs of achieving a given GHG emissions level. Cap-and-trade has been applied successfully in the United States and Canada and in other regions to reduce other pollutants, and a number of countries have implemented such a system for GHGs under the Kyoto Protocol of the UN Framework Convention on Climate Change. In the absence of U.S. and Canadian federal engagement in these efforts, many U.S. states and Canadian provinces are moving ahead on their own and/or in cooperation with neighboring states and provinces to reduce GHG emissions.[32]

Because of their broader coverage, regional cap-and-trade programs perform better than individual state or provincial programs can in terms of realizing cost savings from trade, maintaining competitiveness and avoiding emissions leakage. Emissions leakage occurs when economic activity and associated emissions shift out of the jurisdiction covered by the policy in order to avoid the costs of compliance. The regional program levels the competitive playing field across the participating jurisdictions, thereby reducing the risk of emissions leakage.

Regional cap-and-trade programs can be more efficient and effective than state-by-state and province-by-province efforts because they cover more emissions sources and provide greater opportunities for mutually beneficial transactions. Administrative and technical support functions can also be shared among the participating jurisdictions, lowering the overall costs of implementation. Regional cap-and-trade programs can also help move the United States and Canada toward federal-level policies by acting as laboratories for program design and implementation. RGGI, for example, has advanced the debate in the United States around a number of cap-and-trade design issues, including allowance auctioning and offsets. WCI jurisdictions hope that their own analyses, deliberations, decisions, and implementation experiences will help to accelerate the development of U.S., Canadian, and global GHG markets.

2.2. Lessons from the European Union

The European Union (EU) developed a cap-and-trade program to meet its GHG reduction obligation under the Kyoto Protocol. The EU Emissions Trading Scheme (ETS) covers carbon dioxide emissions from certain sectors, including power generation, certain industrial process sources, and all large industrial combustion facilities. Proposed in 2001, the EU ETS began its three-year "learning phase" in 2005. The goal of the learning phase was to

[32] In addition to the states and provinces participating in the WCI, ten Northeast states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) have joined to form Regional Greenhouse Gas Initiative (www.rggi.org), which is a cap-and-trade program for CO_2 from electrical utilities, and six Mid-Western States (Iowa, Illinois, Kansas, Michigan, Minnesota, and Wisconsin) and one Canadian Province (Manitoba) have signed on to the Mid-Western Greenhouse Gas Reduction Accord (www.midwesternaccord.org) to design a cap-and-trade program for their region.

develop the infrastructure and experience to successfully implement a cap-and-trade program during the second trading period, which started in 2008, and not to achieve significant reductions in GHG emissions, per se.[33]

A number of lessons can be drawn from the EU ETS. In particular, the EU ETS learning phase demonstrated:

- The importance of accurate emissions data to create an effective trading system that results in sufficient emissions reductions and to ensure that the appropriate number of allowances is distributed;
- That cost containment measures such as banking and multi-year compliance periods tend to reduce market volatility;
- Suppliers quickly factor the price of emissions allowances into their business decisions under a cap-and-trade program;
- The relationship between allowance allocation, allowance markets, and electricity regulation must be understood and addressed to avoid unintended consequences; and
- The linkage of 28 separate trading programs in the EU ETS provides a valuable prototype for a globally linked carbon market.

2.3. Lessons from Other Emission Trading Programs[34]

The United States has implemented six emissions trading programs since the late 1970s: the early U.S. EPA emissions trading programs,[35] the federal Lead-in-Gasoline, Acid Rain, and Mobile Source trading programs; the northeast regional NOx Budget Trading Program, and the Los Angeles Air Basin RECLAIM program. From an examination of the literature and experiences with these programs, there are important lessons and recommendations that emerge:

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[33] For a full examination of the EU ETS, see Ellerman, D. A. and P. Jaskow. 2008. *The European Union's Emissions Trading System in Perspective.* Pew Center on Global Climate Change. Available online at: www.pewclimate.org/docUploads/EU-ETS-In-Perspective-Report.pdf

[34] *See for example* www.epa.gov/airmarkets.usca; Aulisi, A., A. E. Farrell, J. Pershing, and S. Vandeveer. 2005. *Greenhouse Gas Emissions Trading in U.S. States. WRI White Paper.* Available online at http://pdf.wri.org/nox_ghg.pdf. Ellerman, A. D., P. L. Joskow, and D. Harrison, Jr. 2003. *Emissions Trading in the U.S*. Pew Center on Global Climate Change. Available online at www.pewclimate.org/global-warming-in-depth/all_reports/emissions_trading. *Climate Change 101: Cap and Trade*. Pew Center on Global Climate Change and Pew Center on States. Available online at www.pewclimate.org/docUploads/Cap&Trade.pdf.

[35] The early EPA programs included four programs—collectively referred to as EPA Emissions Trading or EPA ET—are related by the common objective of providing sources with flexibility to comply with traditional source-specific command-and-control standards while maintaining environmental objectives focused primarily on local air quality. They included netting, offsets, bubbles, and banking. *See* Ellerman, A. D., P. L. Joskow, and D. Harrison, Jr. 2003. *Emissions Trading in the U.S*. Pew Center on Global Climate Change.

- Emission trading has successfully reduced emissions and the costs of achieving those reductions without compromising environmental goals.[36]
- The inclusion of a broad and diverse set of emission sources under the cap will lower costs, achieve the environmental objective, and accelerate innovation, making cap-and-trade particularly applicable for reducing greenhouse gas emissions.
- A common set of rules and guidelines are required for monitoring and reporting emissions to ensure market transparency and compliance.
- Rigorous monitoring of emissions is critical to making the probability of detecting non-compliance high. Penalties for non-compliance must be strict and sure.
- There are some elements of a multi-jurisdictional cap-and-trade program that must be the same between implementing jurisdictions; these include certain elements of measurement and reporting of emissions, the schedule for distributing allowances to covered entities or facilities, compliance and reconciliation periods, the use of banking and/or borrowing, the acceptance of offsets and allowances from other trading programs, and compliance and enforcement.
- Other elements of a multi-jurisdictional cap-and-trade program do not need to be the same across implementing jurisdictions: it is not critical that the states and provinces allocate allowances within their jurisdictions in the same manner and jurisdictions may include varying levels of auction in their allowance distribution.

2.4. WCI Design Principles

To attain the Western Climate Initiative's regional GHG reduction goal, the WCI Partner jurisdictions committed to designing a cap-and-trade system that:

- Is equitable, administratively simple for government and private participants, minimizes administrative costs, and has a clear compliance path;
- Maximizes total benefits in jurisdictions throughout the region, including reducing air pollutants, diversifying energy sources, and advancing economic, environmental, and public health objectives, while also avoiding localized or disproportionate environmental or economic impacts;
- Requires all reductions to be real, verifiable, enforceable, and permanent, and surplus/additional;
- Stimulates investment, especially in low carbon technologies, and rewards innovations that will lead to long-term, permanent greenhouse gas reductions;
- Covers as many sources as is practical, while encouraging pollution reductions beyond the capped sources and sectors;

[36] When compared to a policy that would have forced scrubbing to achieve the same level of emissions (required for acid rain mitigation), cost savings of the Acid Rain Program were estimated to be $1.6 billion per year in 1995 dollars. *See* Carlson, C. P., D. Burtraw, M. Cropper, and K. L. Palmer. 2000. Sulfur dioxide control by electric utilities. *Journal of Political Economy* 108 (6):1292-1326.

- Provides appropriate recognition and incentives for early emissions reductions;
- Assures a transparent and robust accounting system that will measure and report emissions rigorously and consistently across all sectors and throughout the region;
- Minimizes the potential for leakage; and
- Facilitates linkage to similarly rigorous regional and international greenhouse gases reduction markets and encourages other states, provinces, and countries to join the market.

2.5. Statement on the Overall Policy Design

The WCI Partners are proposing the most expansive cap-and-trade program in U.S. history, covering more sectors than the EU ETS in a broad, multi-sector greenhouse gas cap-and-trade program. As designed, the program will cover approximately 90 percent of the region's GHG emissions. Recognizing that federal mandatory GHG reduction programs might emerge in the United States and/or Canada, the WCI Partner jurisdictions have designed a program that can stand alone, provide a model for, be integrated into, or be implemented in conjunction with future federal programs. The WCI Partner jurisdictions intend to promote and influence federal GHG emission reduction programs that are consistent with the WCI cap-and-trade design principles and to ensure those programs translate into absolute GHG reductions. In the event WCI issues allowances before a federal program in Canada or the United States, the WCI Partner jurisdictions will work to ensure, but cannot guarantee, that those allowances are fully recognized and valued in the operation of a federal program.

3. Process to Date and Continued Work

3.1. Setting the Regional Goal

The WCI Partner jurisdictions issued their regional GHG reduction goal on August 22, 2007 to achieve an aggregate reduction of 15 percent below 2005 levels by 2020.[37] The WCI regional goal is consistent with the state and provincial goals of the WCI Partner jurisdictions and does not replace the existing goals of the individual WCI Partner jurisdictions. Several metrics were used to establish this goal, including:

- The aggregation of GHG emissions and emissions goals of the WCI Partner jurisdictions;
- Currently available state and provincial emissions inventories, including gross emissions estimates, across all sectors, for the six GHGs reported to the United Nations Framework Convention on Climate Change by the U.S. Environmental Protection Agency in the US Greenhouse Gas Inventory and by Environment Canada in the Canada National Inventory Report: carbon dioxide (CO_2), methane (CH_4), nitrous

[37] *See* Western Climate Initiative Statement of Regional Goal. Available online at www.westernclimateinitiative.org/ewebeditpro/items/O104F13006.pdf.

oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6); and[38]

- Where available, consumption-based (or "load-based") emissions estimates for the electricity sector, reflecting the emissions associated with generating the electricity delivered to consumers in each state or province regardless of whether the electricity was generated in state/province or out of state/province.

The WCI Partner jurisdictions also committed to doing their share to reduce regional GHG emissions sufficiently over the long term to significantly lower the risk of dangerous threats to the climate. Current science suggests that this will require worldwide reductions in carbon dioxide emissions of 50 to 85 percent below 2000 levels by 2050.[39]

3.2. The Work of the Subcommittees

Five WCI subcommittees were formed to work toward a cap-and-trade program design that all WCI Partner jurisdictions can embrace and recommend for implementation in their jurisdiction. The five subcommittees and their purposes were:

- Reporting. Recommend the GHG emissions reporting system needed to support the WCI cap-and-trade program.
- Electricity. Recommend the point of regulation for the electricity sector.
- Scope. Recommend what other sectors and sources to include in the cap-and-trade program in addition to the electricity sector and the appropriate point of regulation for each sector.
- Allocations. Recommend how to apportion emissions allowances among the WCI Partner jurisdictions and how WCI Partner jurisdictions should distribute allowances to achieve jurisdictional and regional goals.
- Offsets. Recommend whether and how emissions offsets should be included.

Each subcommittee was chaired by a representative of one of the WCI Partner jurisdictions, composed of staff from WCI Partner and observer jurisdictions, and had support from various consultants and advisors working under contract to the Western Governors' Association. During the development of the draft program design, the subcommittees met regularly by conference call and at times held face-to-face meetings. All subcommittees incorporated stakeholder involvement and feedback to help design the program.

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[38] *See* EPA. 2008. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. Available online at: www.epa.gov/climatechange/emissions/usinventoryreport.html. Environment Canada. 2008. *National Inventory Report 1990-2006: Greenhouse Gas Sources and Sinks in Canada – The Canadian Government's Submission to the UN Framework Convention on Climate Change*. Available at: www.ec.gc.ca/pdb/ghg/inventory_e.cfm.

[39] IPCC. 2007. *Climate Change 2007: Synthesis Report; Summary for Policymakers.* Available online at: www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

In addition to these five subcommittees, an Economic Modeling Team (EMT) was established to prepare the work plan for, select, and oversee the work of a contractor to evaluate the potential economic impact of the cap-and-trade program. This effort is on-going and includes outreach to stakeholders to receive advice and data to bolster the assumptions and inputs that underlie the modeling exercise.

3.3. Stakeholder Process for the Design Recommendations

Throughout the WCI cap-and-trade design process, there have been many opportunities and methods for stakeholder input on a regional level. These opportunities supplemented and did not replace extensive stakeholder consultations at the state and provincial level. In addition, states and provinces have and are continuing to conduct extensive stakeholder consultations. The decisions reached throughout the design process have benefited greatly from stakeholder input.

The regional stakeholder process for the Design Recommendations included a number of important avenues for the sharing of information and input. Among them:

- Stakeholder Workshops. Five regional stakeholder workshops were held to allow face-to-face interaction between stakeholders and WCI Partner jurisdictions and staff. Three of these workshops were comprehensive and included subcommittee-specific sessions to explore the subject areas within each subcommittee's purview. The other two addressed offsets and electricity point-of-regulation specifically. The workshops are noted in the table below.
- Stakeholder Conference Calls. Over the course of the design effort, the WCI Partner jurisdictions held regional stakeholder conference calls to update stakeholders on progress toward a cap-and-trade design and to answer stakeholder questions.
- Review and Comment in Writing. At regular intervals throughout the process, the WCI Partner jurisdictions and the subcommittees released written work for review and comment by stakeholders.
- The Website.[40] The WCI website served as a repository for information on the design effort. The website included information on upcoming stakeholder calls and workshops, and also provided a way to submit comments to the WCI Partner jurisdictions.

The table below details the various stakeholder events along with the work products released by WCI leading up to the release of the Design Recommendations accompanying this document. As noted above, the activities outlined in the table are in addition to the individual outreach to stakeholders conducted by each individual WCI Partner jurisdiction.

[40] The Western Climate Initiative website can be accessed at www.westernclimateinitiative.org.

Part 1, Cap-and-Trade Program Design, summarizes stakeholder input on the cap-and-trade program design elements.

Table 1: The WCI Stakeholder Input Process Through September 2008

Activity	Date
Periodic Stakeholder Conference Calls	Summer-Fall 2007
Subcommittee Options Papers released for public review and comment[41]	Early January 2008
Stakeholder Workshop, Portland, OR[42]	January 10, 2008
Initial Draft Scope Recommendations and Electricity Point of Regulation Recommendations released for public review and comment	February 3, 2008
Stakeholder Conference Calls with Scope and Electricity Subcommittees	February 11, 2008
Scope of Work for Economic Analysis[43] released for public review and comment	March 3, 2008
Initial Draft Design Recommendations released[44] for public review and comment • Scope and Electricity • Offsets, Allocations, and Reporting	 March 5, 2008 April 3, 2008
Stakeholder Conference Calls with Subcommittees	Week of March 11, 2008
Offsets Workshop in Vancouver, BC[45]	March 26, 2008
Stakeholder Conference Call with Economic Modeling Team[46]	March 28, 2008
Stakeholder Conference Call with Economic Modeling Team	April 14, 2008
Stakeholder Conference Call with Economic Modeling Team	May 12, 2008
Consolidated WCI Draft Recommendations released[47] for public review and comment	May 16, 2008
Stakeholder Workshop in Salt Lake City, UT to discuss draft subcommittee recommendations[48]	May 21, 2008

[41] Allocation, Electricity, Offsets, Reporting, and Scope Options Papers are available online at www.westernclimateinitiative.org/WCI_Documents.cfm.

[42] Public workshop presentations are available online at www.westernclimateinitiative.org/WCI_Meetings_Events.cfm.

[43] Stakeholder involvement opportunities for the economic modeling effort are available online at www.westernclimateinitiative.org/Economic_Analysis.cfm.

[44] Draft Design Recommendations are available online at www.westernclimateinitiative.org/WCI_Documents.cfm.

[45] Offsets workshop materials are available online at www.westernclimateinitiative.org/WCI_Meetings_Events.cfm.

[46] Materials from the Economic Modeling Team's conference calls are available online at www.westernclimateinitiative.org/Economic_Analysis.cfm

[47] The Consolidated Draft Recommendations are available online at www.westernclimateinitiative.org/ewebeditpro/items/O104F17390.PDF.

Activity	Date
Stakeholder Conference Call with Economic Modeling Team	June 9, 2008
Electricity Subcommittee Meeting on Technical Issues Related to First Jurisdictional Deliverer in Portland, OR	July 17, 2008
Stakeholder Conference Call with Economic Modeling Team	July 21, 2008
Draft Program Design Recommendations[49] released for public review and comment	July 23, 2008
Stakeholder Workshop in San Diego, CA to Discuss Draft Design Recommendations	July 29, 2008
Final Design Recommendations to be Delivered to Governors and Premiers	September 23, 2008

3.4. Continued Work

The Design Recommendations released along with this document represent the final high-level design elements for the cap-and-trade program. Many of the design aspects will require further development. The WCI Partner jurisdictions' next task will be to develop a work plan that identifies and prioritizes those items and develop a schedule for their completion. The work plan will be shared with stakeholders once it is complete. The work plan will include opportunities for stakeholders to advise, comment, and participate in the further development of the cap-and-trade program.

4. Economic Analysis

4.1. Insights from Prior Analyses of Climate Policies

The potential economic impacts of climate protection policies have been the subject of considerable analysis and debate for more than a decade. Recognizing that significant reductions in GHG emissions are required globally to prevent the most serious climate change impacts, studies have examined how to design climate policies to minimize economic impacts. One of the important recommendations from the recent work has been that market-based policies, such as cap-and-trade programs, can reduce emissions at a lower cost than can be achieved through traditional regulation. This conclusion is grounded in economic theory as well as empirical evidence from past cap-and-trade program experience. Specifically, comprehensive carbon pricing through a cap-and-trade program takes advantage of the diverse opportunities to reduce emissions throughout the economy and provides incentives for continued innovation.

Recent efforts, therefore, move past the basic question of whether to use market-based policies, such as a cap-and-trade program, and onto the question of how to best design a

[48] Meeting agenda and presentations are available online at www.westernclimateinitiative.org/WCI_Meetings_Events.cfm.

[49] The Draft Design Recommendations are available online at www.westernclimateinitiative.org/ewebeditpro/items/O104F18808.PDF.

cap-and-trade program. To inform the design of this program, the WCI Partner jurisdictions examined program guidance,[50] U.S. analyses of the Lieberman-Warner Climate Security Act and California AB32, and Canadian analyses by Environment Canada and British Columbia. These analyses consistently demonstrated that several program design features can have an important impact on compliance costs:

- Flexibility in the timing of GHG reductions reduces the overall costs of cumulative GHG abatement. Multiple-year compliance periods and allowance banking have been identified as effective approaches for providing flexibility.
- Allowing offset credits to be used for program compliance can lower the compliance cost of meeting emission reduction targets.
- A broad scope that covers more sectors in a cap-and-trade program can lower compliance costs by providing maximum opportunities to pursue low-cost emission reductions.

Studies have also shown that innovation in advanced, low-carbon technologies (such as carbon capture and storage for electric power generation) can have a substantial impact on compliance costs, particularly after 2020. Consequently, providing incentives for technology development and demonstration is important for minimizing costs.

Complementary policies have also been examined as a means for addressing market barriers that would otherwise hinder the exploitation of low-cost GHG emission reduction opportunities (e.g., via improved energy efficiency). Thus, complementary policies can lower the overall cost of reducing GHG emissions. Analysts differ in their treatment of complementary policies, however. Some analysts allow for cost savings to be realized from complementary policies such as building codes, appliance standards, vehicle standards, and energy efficiency programs. A recent McKinsey analysis of GHG abatement costs in the United States provides one view of the potential for gains from complementary policies.[51] McKinsey found significant opportunities to reduce GHG emissions while also saving money through investments in energy efficiency. The existence of opportunities to reduce GHG emissions at "negative cost" even in the absence of a cap-and-trade program suggests that complementary policies, such as energy efficiency standards and programs, can lead households and businesses to exploit such opportunities.

Other analysts start with the presumption that markets function efficiently, so that there is little or no opportunity for these complementary policies to lead to overall savings.[52] Under these assumptions, any climate policies must impose economic costs. This divergence of views on the potential to realize savings from complementary policies is one of the primary

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[50] See, for example, U.S. Environmental Protection Agency, *A Guide to Designing a Cap and Trade Program for Pollution Control*, Office of Air and Radiation, Washington, D.C., EPA430-B-03-002, June 2003, available online at: www.epa.gov/airmarkt/resource/cap-trade-resource.html.

[51] Creyts, J., et al. (McKinsey). 2007.

[52] See generally Stavins, Robert et al. 2007. "Too Good to Be True? An Examination of Three Economic Assessments of California Climate Change Policy." AEI-Brookings Joint Center Working Paper No. 07-01.

factors that causes some studies to show a small net savings to the economy from climate policies, while others show a small net cost. What is important to recognize is that in virtually all analyses, well defined cap-and-trade programs with the cost-saving features listed above have been found to be consistent with continued robust economic growth in the U.S. and Canada. By coupling a cap-and-trade program with complementary policies, the WCI Partners expect to use the market to capture cost-effective reduction opportunities and drive innovation, while targeted complementary policies address barriers that might otherwise limit the adoption of least-cost emission reductions.

4.2. WCI Economic Analysis

In order to examine the economic impacts of WCI program design options, WCI Partner jurisdictions contracted with ICF International and Systematic Solutions, Inc. (SSI) to perform economic analyses using ENERGY 2020,[53] a multi-region, multi-sector energy model. The workings of the model and the inputs to the model were the subject of multiple stakeholder conference calls and were discussed at two WCI stakeholder workshops. Appendix B presents the results of the analysis.

To help inform the program design process, the analysis examined the implications of key design decisions, including: program scope, allowance banking, and the use of offsets. Due to time and resource constraints, the modeling was limited to the eight WCI Partner jurisdictions in the Western Electric Coordinating Council (WECC) area, thereby excluding from the analysis three Canadian provinces, Manitoba, Quebec, and Ontario. Future analyses are planned that will integrate these provinces so that a full assessment of the WCI Partner jurisdictions can be performed.

The results of the analysis provided the following insights into the program design:[54]

- Complementary Policies: The analysis demonstrated that energy efficiency programs, vehicle emissions standards, and programs to reduce vehicle miles traveled (VMT) are important for achieving emission reductions. The manner in which these policies are represented in ENERGY 2020 results in overall savings being realized from these policies. Resources from the cap-and-trade program (e.g., from the auctioning of emission allowances) can fund these complementary programs.
- Banking: The analysis demonstrated that the ability to bank allowances is critical for reducing compliance costs. Throughout all the cases examined, emission allowances

[53] More about the ENERGY 2020 model can be found online at www.energy2020.com/energy.htm.

[54] Like all analyses of climate policies, this analysis relies on a model to explore alternative policy choices and provide insights about how the economy might respond to different types and forms of regulation. The insights derived from the studies do not depend on perfectly accurate projections of the future or precise estimates of economic variables. Rather, modeling studies assess the relative impacts of policy alternatives, to estimate the likely economic effects of policies and to identify preferred policy choices. For a review of how economic models can be used in policymaking, see: Peace, Janet and John Weyant. 2008. "Insights Not Numbers: The Appropriate Use of Economic Models." White Paper prepared for the Pew Center on Global Climate Change, available at http://www.pewclimate.org/white-paper/economic-models-are-insights-not-numbers

were estimated to be banked in early years when allowance prices were below $10/metric ton, and used when allowance prices rose in later years.

- Offsets: The analysis demonstrated that under certain circumstances, offsets provide an effective mechanism for limiting compliance costs. In the analysis performed to date, offsets were assumed to be available at $20/metric ton. As allowance prices were estimated to rise to this level, offsets were estimated to be used in combination with allowance banking to reduce compliance costs.

Overall, the analysis found that the WCI Partner jurisdictions can meet the regional goal of reducing emissions to 15 percent below 2005 levels by 2020 with a small overall savings due to reduced energy expenditures exceeding the direct costs of GHG emission reductions.[55] The savings are focused primarily in the residential and commercial sectors, where energy efficiency programs and vehicle standards are expected to have the most significant impacts. Energy-intensive industrial sectors are estimated to have small net costs overall (less than 0.5 percent of output). When offsets are included in the analysis, allowance prices are estimated to increase from $6/metric ton in 2015 to about $24/metric ton in 2020. If offsets are not included, or if they cost substantially more than $20/metric ton, then the allowance price is estimated to be higher. To date the analysis has included a simplified representation of the potential supply of offsets. Additional work is being considered to develop a better estimate of the supply of offsets under various offset program policies.

The analysis examined the sensitivity of the results to various assumptions. The analysis suggests a net savings whether future energy prices are higher or lower than in the Reference Case. It also suggests a net savings with higher electricity power generation costs. If the program scope were narrowed to exclude transportation fuels and residential and commercial fuels, the overall impacts would be similar, but allowance prices may be expected to be higher because the program is focused on a smaller group of sources. If the program causes a substantial increase in natural gas prices, then the overall impact is estimated to be a small net cost to the economy. However, the program is not expected to lead to increases in natural gas prices. As discussed with stakeholders during the WCI economic analysis conference calls, it is worthwhile to explore many additional sensitivities to better understand the implications of various analytical assumptions and inputs. However, time and resources did not allow additional sensitivities to be examined for this report.

These WCI modeling results are generally consistent with the findings of prior modeling studies of both U.S. and Canadian programs. Offsets and allowance banking provide compliance flexibility that reduces allowance prices. The analysis suggests that offsets are particularly important during the years approaching 2020, but may play a minor role in the early years of the program when allowance prices are expected to be less than $10/metric ton. The overall net savings that are found are consistent with studies that assume that complementary policies, such as energy efficiency programs and vehicle standards, can

[55] Reduced energy expenditures are caused by improved energy efficiency.

result in economic savings. While the overall costs and savings from emission reductions and reduced fuel expenditures are small, potential impacts on specific energy-intensive industrial sectors warrant additional examination. In particular, the results reinforce the need to consider strategies for mitigating economic impacts on industries facing competition from facilities that are not included in climate policies.

In considering the results of the WCI analysis, it is worth highlighting several important assumptions:

- It is assumed that no new nuclear power or hydropower generation capacity will be built prior to 2020. Therefore, the analysis does not include any increase in this power as a result of the cap-and-trade program.
- It is assumed that no carbon capture and storage for electric power generation will be built prior to 2020. Consequently, the analysis does not include the benefits of this carbon-sequestering technology.
- It is assumed that no new coal-fired power plants are built in the WECC states and provinces through 2020 beyond those that are already planned.
- It is assumed that plug-in hybrid electric vehicles will not be produced in any significant quantity prior to 2020. Thus, the model does not include an increase in this low carbon transportation alternative as a result of the cap-and-trade program.
- For the U.S. states, the requirements of the Energy Independence and Security Act (EISA) are assumed to be part of the Reference Case against which the cap-and-trade program is evaluated. For the Canadian provinces, lighting, equipment, and appliance standards as set out by the Canadian Standards Association as well as the federal "ecoENERGY" Renewable Fuels Strategy are included in the Reference Case.

Finally, the analysis does not examine the potential macroeconomic impacts of the costs and savings estimated with ENERGY 2020. The WCI Partner jurisdictions are planning to continue the analysis so that macroeconomic impacts, such as income, employment, and output, can be assessed. Once completed, the macroeconomic impacts can be compared to previous studies of cap-and-trade programs considered in the United State and Canada.

4.3. Benefits of Cap-and-Trade Not Fully Represented in Economic Models

Economic models are by necessity simplified representations of the real-world economy, including the characteristics of and relationships among the households and firms that constitute the economy. The simplified nature of these models means that they may not fully capture all of the advantages of market-based climate policies, such as cap-and-trade programs, compared to prescriptive standards (i.e. command-and-control or direction regulation). The aspects of the real-world economy that are imperfectly represented in models are described below along with the implications for how well modeling studies capture the true advantages of market-based climate policies.

Heterogeneity: In direct regulation, all facilities in an industry are required to achieve a given level of performance or emission reduction. Modeling tools typically represent the industry as a single "model facility" or as a sector with demand and supply elasticities. In reality, industry is actually heterogeneous with different facilities facing different costs for reducing emissions. An important benefit of cap-and-trade is that it allows the low cost facilities to do more than the high cost facilities—i.e. the market directs the least-cost emissions reductions. The existing modeling tools may not fully capture this benefit of cap-and-trade, thus underestimating the relative cost-effectiveness of cap-and-trade compared to other policies.

Diffuse Behavioral Change: The price signal from a market program such as cap-and-trade will create consumer behavior change throughout the economy that is diffuse and not necessarily captured by existing modeling tools. These behavior changes are responses to persistent price signals that are not reflected in elasticities and are not part of "model facility" engineering cost studies. For example, bottom-up energy models may show that efficient lighting will be installed at a given allowance price, but it may not show that the consumer will also use the lights more efficiently. Existing modeling tools may not fully reflect these effects.

Induced Innovation: The price signal from a market program such as cap-and-trade will induce technological innovation in a way that is not adequately included in models.

Errors in Direct Regulation Cost Estimates: When direct regulations are promulgated, the costs of complying with the regulations will likely be estimated incorrectly, either too high or too low. When a portfolio of direct regulations is being developed, the mix and stringency of the regulations will be incorrectly estimated as a result. If the cost estimates are too high for a regulation, that regulation will not be strict enough. If the cost estimate is too low, that regulation may be too strict. Market programs such as cap-and-trade do not suffer from this problem, as the market sorts out who should do what to achieve the total emission reduction needed. Existing modeling tools presume that the costs of control are known in advance and are correct. Consequently, the benefit of avoiding these cost estimating errors is not captured by the models, thereby under-estimating the benefits of using market programs.

Appendix A: Western Regional Climate Action Initiative Agreement

Note: This agreement was subsequently signed by: Premier Gordon Campbell, British Columbia, Premier Gary Doer, Manitoba, Governor Jon Huntsman, Utah, Governor, Brian Schweitzer, Montana, Premier Jean Charest, Quebec, and Premier Dalton McGuinty, Ontario

Christine O. Gregoire **Theodore R. Kulongoski** **Arnold Schwarzenegger**

Janet Napolitano **Bill Richardson**

WESTERN REGIONAL CLIMATE ACTION INITIATIVE

WHEREAS, western states are experiencing the effects of a hotter, drier climate, including prolonged droughts, excessive heat waves, reduced snow packs, increased snowmelts, decreased spring runoffs, altered precipitation patterns, more severe forest and rangeland fires, widespread forest diseases, and other serious impacts; and

WHEREAS, scientific consensus has developed that increasing emissions of human-caused greenhouse cases (GHGs), including carbon dioxide, methane and other GHGs, that are released into the atmosphere are affecting the Earth's climate; and

WHEREAS, the Western Governors Association (WGA) has declared that climate change could have severe economic and environmental impacts on the Western States in coming decades; and

WHEREAS, the WGA also has declared that action is needed to reduce GHG emissions and that many of these actions can have significant economic and environmental benefits for the Western States, including increased energy efficiency, increased renewable energy generation, improved air quality, cost savings, job growth, increased state revenues, and reduced water pollution; and

WHEREAS, we support the development of national, regional, tribal, state and local programs to reduce GHG emissions; and

WHEREAS, we support national, regional, tribal, state and local level policies on global climate change that are consistent with efforts to develop cost-effective alternative energy sources and more efficient use of energy; and

WHEREAS, we recognize the need for collaboration among states to develop climate change policies that provide consistent approaches to recognize and give credit for actions to reduce GHG emissions; and

WHEREAS, we have already adopted or committed to adopt clean tailpipe standards for passenger vehicles that will result in major reductions in GHG emissions and other pollutants; and

WHEREAS, we support market-based policies to reduce GHG emissions in the most cost-effective manner; and

WHEREAS, we have set goals to significantly reduce GHG emissions from our respective states; and

WHEREAS, we welcome expanding the partners to this initiative to other states, tribes, Canadian provinces and Mexican states and offer monitoring status to any state, tribe or province interested in observing the initiative;

NOW, THEREFORE, we, the undersigned Governors, jointly establish the Western Regional Climate Action Initiative and agree to collaborate in identifying, evaluating and implementing ways to reduce GHG emissions in our states collectively and to achieve related co-benefits. This collaboration shall include, but is not limited to:

- Setting an overall regional goal, within six months of the effective date of this initiative, to reduce emissions from our states collectively, consistent with state-by-state goals;
- Developing, within eighteen months of the effective date of this agreement, a design for a regional market-based multi-sector mechanism, such as a load-based cap and trade program, to achieve the regional GHG reduction goal; and
- Participating in a multi-state GHG registry to enable tracking, management, and crediting for entities that reduce GHG emissions, consistent with state GHG reporting mechanisms and requirements.

In addition, we commit to continue our independent and collaborative efforts to reduce GHG emissions through:

- Promoting the development and use of clean and renewable energy within the region;
- Increasing the efficiency of energy use within our jurisdictions;
- Advocating regional and national climate policies that reflect the needs and interests of western states, tribes and provinces; and
- Identifying measures in our states, tribes and provinces to adapt to the impacts of climate change.

We will direct our staffs and the appropriate state agencies to meet as soon as is practicable to develop a work plan to move forward with this initiative.

DONE, in five (5) duplicate originals, this 26th day of February, 2007, in Washington, D.C.

Governor Christine O. Gregoire
State of Washington

Governor Theodore R. Kulongoski
State of Oregon

Governor Janet Napolitano
State of Arizona

Governor Bill Richardson
State of New Mexico

Governor Arnold Schwarzenegger
State of California

Appendix B: Economic Modeling Results

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Appendix B: Economic Modeling Results

Introduction

This appendix presents data from the economic modeling performed for WCI, including the model inputs and outputs for the cases examined. The focus here is on the data and assumptions used as model inputs and the model outputs. The main body of the Background Document discusses the policy implications of the model results.

This appendix is organized as follows:

- Cases Analyzed: describes the cases presented in this appendix.
- ENERGY 2020: provides a brief technical discussion of the model used.
- Assumptions: lists the primary assumptions used in the model.
- Outputs: defines the model outputs that are presented for the cases.
- Summary Results: provides a brief table of key model outputs.
- Reference Case: presents the results of the Reference Case.
- Cap-and-Trade Policy Cases: presents the results of the cap-and-trade policy cases.
- Sensitivity Cases: presents the results of three sensitivity cases.

As discussed below, additional detail on the ENERGY 2020 model and the model inputs and assumptions used in this analysis are presented in the *Assumptions Book for ENERGY 2020* posted on the WCI website.[1]

Cases Analyzed

This appendix presents three groups of cases. The first group is the Reference Case which reflects expectations in the absence of the WCI policies to reduce greenhouse gas emissions.

The second group is the Cap-and-Trade Policy Cases. These cases examine the primary alternatives for the cap-and-trade program, including whether to allow the use of offsets and whether to have a narrow or broad scope. The narrow scope includes stationary sources (including process emissions) and the electric sector. The broad scope also includes transportation fuels and residential/commercial fuels. The cases presented are:

- broad scope without offsets;
- broad scope with offsets; and
- narrow scope with offsets.

For all three Cap-and-Trade Policy cases, complementary policies are included along with the cap-and-trade program, including clean car standards, programs to reduce vehicle miles traveled, and energy efficiency programs. These complementary policies are defined below.

The third group of cases is the Sensitivity Cases. The purpose of the sensitivity cases is to assess the impacts of various assumptions and inputs on the model results. These assumptions can affect both the Reference Case and the Policy Cases. While a large number of

[1] The WCI website is: www.westernclimateinitiative.org.

assumptions and sensitivities are of interest, this analysis focuses on three sensitivities that were identified as most important by WCI partner jurisdictions and stakeholders.

- High Energy Prices and High Generation Costs: This sensitivity includes both higher energy prices and higher power generation costs as a set of conditions that could occur together in the future. This sensitivity was performed for both the Reference Case and the Policy Case with the broad scope and offsets.
- Low Energy Prices: This sensitivity uses energy prices that are lower than those used in the Reference Case. This sensitivity was performed for both the Reference Case and the Policy Case with the broad scope and offsets.
- High Natural Gas Prices: This sensitivity was designed to examine the impact of higher natural gas prices that may be induced by policies that are undertaken to reduce greenhouse gas emissions. Consequently, this sensitivity was applied to the Policy Case with broad scope and offsets. The results of this Policy Case are compared to the Reference Case with the standard natural gas price assumptions because the presumption is that policies are inducing the natural gas prices to increase.

Additional sensitivity analyses are warranted, and many important and worthwhile issues were identified by stakeholders during the conference calls and workshops that covered this work. However, due to time and resource constraints, additional sensitivities are not included at this time. Future work is anticipated that will enable additional sensitivity analyses to be performed.

ENERGY 2020

ENERGY 2020 was used to perform this analysis. A description of ENERGY 2020 is in the *Assumptions Book for Energy 2020* posted on the WCI website.[2] Additional documentation is available on the California Air Resources Board (ARB) website.[3] The following is a brief summary.

ENERGY 2020 is an integrated multi-region energy model that provides all-fuel demand and supply sector simulations. ENERGY 2020 can be linked to a detailed macroeconomic model to determine the economic impacts of energy/environmental policy and the energy and environmental impacts of national economic policy. However, the macroeconomic analysis was not performed for this study.

The model simulates demand by three residential categories (single family, multi-family, and agriculture/rural), over 40 NAICS commercial and industrial categories,[4] and three transportation services (passenger, freight, and off-road). There are approximately six end-uses per category and six technology/mode families per end-use.[5] The technology families

[2] The WCI website is: www.westernclimateinitiative.org.

[3] The posting on the ARB website is at: http://www.arb.ca.gov/cc/scopingplan/economics-sp/models/models.htm.

[4] NAICS is the North America Industrial Classification System which was developed jointly by the U.S., Canada, and Mexico to provide new comparability in statistics about business activity across North America.

[5] End-uses include Process Heat, Space Heating, Water Heating, Other Substitutable, Refrigeration, Lighting, Air Conditioning, Motors, and Other Non-Substitutable (Miscellaneous). Detailed modes include: small auto, large

correspond to six fuels groups (oil, gas, coal, electric, solar and biomass) and 30 detailed fuel products. The transportation sector contains 45 modes including various type of automobile, truck, off-road, bus, train, plane, marine and alternative-fuel vehicles. More end-uses, technologies, and modes can be added as data allow. For all end-uses and fuels, the model is parameterized based on historical, locale-specific data. The load duration curves for electricity demand are dynamically built up from the individual end-uses to capture changing conditions under consumer choice and combined gas/electric programs.

Each energy demand sector includes cogeneration, self-generation, and distributed generation simulation, including mobile-generation, micro-turbines, and fuel-cells. Fuel-switching responses are rigorously determined. The technology families (which can be split, as an option, to portray specific technology dynamics) are aggregates that, within the model, change building shell, economic-process and device efficiency and capital costs as price or other information that the decision makers see, change. ENERGY 2020 utilizes the historical and forecast data developed for each technology family to parameterize and disaggregate the model.

The supply portion of the model includes endogenous detailed electric supply simulation of capacity expansion/construction, rates/prices, load shape variation due to weather, and changes in regulation.[6] The model dispatches plants according to the specified rules whether they are optimal or heuristic and simulates transmission constraints when determining dispatch. A dispatch routine selects critical hours along seasonal load duration curves as a way to determine system generation. Peak and base hydro usage is explicitly modeled to capture hydro-plant impacts on the electric system.

ENERGY 2020 supply sectors include electricity, oil, natural gas, refined petroleum products, ethanol, land-fill gas, and coal supply. Energy used in primary production and emissions associated with primary production and its distribution is included in the model. The supply sectors included in a particular implementation of ENERGY 2020 will depend on the characteristics of the area being simulated and the problem being addressed. If the full supply sector is not needed, then a simplified simulation determines delivered-product prices.

ENERGY 2020 includes pollution accounting for both combustion (by fuel, end-use, and sector) and non-combustion, and non-energy (by economic activity) for SO_2, NO_2, N_2O, CO, CO_2, CH_4, PMT, $PM_{2.5}$, PM_5, PM_{10}, VOC, CF_4, C_2F_6, SF_6, and HFC at the state and provincial level by economic sector.

Assumptions

This section presents an overview of the major assumptions used in the modeling analysis. The *Assumptions Book for ENERGY 2020* presents a detailed list of the model inputs, including links to the data sources used to assemble the input data.

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auto, light truck, medium-weight truck, heavy-weight truck, bus, freight train, commuter train, airplane, and marine. Each mode type can be characterized by gasoline, diesel, electric, ethanol, NG, propane, fuel-cell, or hybrid vehicles.

[6] ENERGY 2020 includes a complete, but aggregate representation of the electric transmission system.

- Geographic Coverage: This phase of the analysis covers the area of the Western Electricity Coordinating Council (WECC), which includes eight WCI partners: British Columbia, Washington, Oregon, California, Arizona, New Mexico, Utah, and Montana. By covering the entire WECC, the impacts of the WCI programs and policies on electricity generation in the non-WCI WECC states and provinces can be examined. Future analyses are planned that will incorporate the WCI partners that are not in the WECC, including Manitoba, Ontario, and Quebec.
- Sectors and Sources: This phase of the analysis includes energy use in all sectors, as well as most industrial process emissions. Landfill methane emissions and non-energy agriculture emissions are included in the total emissions estimates, but emission reductions are not estimated for these sources.[7] The analysis is based on gross emissions, so that forestry emissions and sinks are excluded.
- WCI Population and GDP Forecast: The model is driven by forecasts provided as input that include population growth and economic growth by detailed sector. Table B-1 shows the population growth forecast and Table B-2 shows the economic growth forecast.

Table B-1: Population Forecast for Eight WCI Partners, Selected Years (Millions)

Jurisdiction	2006	2010	2015	2020	Annual Growth
Arizona	6.2	7.0	7.9	8.8	2.5%
British Columbia	4.3	4.5	4.7	4.9	0.9%
California	37.4	39.1	41.5	44.1	1.2%
Montana	0.9	1.0	1.1	1.2	1.6%
New Mexico	2.0	2.2	2.3	2.5	1.8%
Oregon	3.7	3.9	4.1	4.3	1.1%
Utah	2.6	2.7	3.0	3.2	1.6%
Washington	6.4	6.8	7.3	7.7	1.4%
WCI	**63.5**	**67.2**	**71.9**	**76.7**	**1.4%**
Source: Assumptions Book for ENERGY 2020					

[7] Examples of non-energy agriculture emissions are methane emissions from livestock, carbon and N_2O emissions from agricultural soils, and methane emissions from livestock manure management.

Table B-2: Regional Gross Product Forecast for Eight WCI Partners, Selected Years (Billions of 2007 US dollars)

Jurisdiction	2006	2010	2015	2020	Annual Growth
Arizona	237	271	322	363	3.1%
British Columbia	266	294	326	358	2.1%
California	1,800	2,066	2,458	2,782	3.2%
Montana	33	37	42	47	2.5%
New Mexico	77	87	103	117	3.0%
Oregon	159	186	227	259	3.6%
Utah	98	111	129	146	2.9%
Washington	302	345	410	462	3.1%
WCI	**2,972**	**3,396**	**4,018**	**4,534**	**3.1%**
Source: Assumptions Book for ENERGY 2020					

- Emission Reduction Options: The model simulates decisions by energy users for each end use, including: fuel choice; investment in end use efficiency (e.g., by purchasing devices that are more efficient than the minimum required by standards); and end use utilization (how much the device is used). End-use specific choices are simulated as needed, such as mode choice for freight movement and passenger transportation. Choices are simulated based on costs (increased capital costs versus the value of fuel saved) as well as non-price attributes (convenience, acceptance of the technology). Past purchasing behavior is used to calibrate the non-price choice parameters for each end use.
- Energy Independence and Security Act of 2007 (EISA): The Reference Case, Policy Cases, and Sensitivity Cases include the requirements in the EISA, including the CAFÉ standards, appliance and lighting energy efficiency standards, and the renewable fuels standard (RFS). These requirements are assumed to be implemented fully in the WCI partner jurisdictions in the United States. For British Columbia and other Canadian provinces, lighting, equipment and appliance standards as set out by the Canadian Standards Association[8] as well as federal "ecoENERGY" Renewable Fuels Strategy[9] are incorporated.
- Renewable Portfolio Standards: All cases incorporate the individual Partner's already-adopted Renewable Portfolio Standards (RPS). See Appendix I of the *Assumptions Book for ENERGY 2020* for details.

[8] http://www.oee.nrcan.gc.ca/regulations/home_page.cfm

[9] This strategy requires 5% average renewable content based on the gasoline pool that is produced or imported, starting in 2010, and 2% average renewable content in diesel fuel and heating oil (distillate) by 2012. The Canada Gazette indicates that the 2% renewable content in diesel fuel and heating oil is equivalent to 5% renewable content in on-road diesel use. (See http://canadagazette.gc.ca/partI/2006/20061230/html/notice-e.html#i3)

- WCI Fuel Prices: The model is also driven by forecasts of fuel prices (oil, coal, natural gas). The model calculates electricity prices internally. Table B-3 shows the fuel price forecast used in the Reference Case. This forecast is taken from the Energy Information Agency's Annual Energy Outlook 2008 high price series. State- and province-specific prices are derived in the model from the prices shown in this table.

Table B-3: Fuel Price Forecast

	2006	2010	2015	2020
World Oil Price (2007 US$/barrel)	64.32	76.22	86.92	97.90
Natural Gas Wellhead Price (2007 US$/mmBtu)	6.93	7.50	7.13	7.29
Coal Prices (2007 US$/ton)	25.33	26.91	24.78	24.29
Source: EIA Annual Energy Outlook 2008 high price series.				

- First Jurisdictional Deliverer: All cases incorporate a proxy to represent First Jurisdictional Deliverer. Consequently, emissions from electricity imported into the WCI partner jurisdictions from outside the WCI partner jurisdictions are included in the analysis.
- Allowance Banking: The model enables allowances to be banked when allowance prices are low, and for allowances to be used from the bank when allowance prices are high. Attachment 1 discusses the parameters used to model allowance banking.
- Coal Plants: The cases allow no new coal plants to be built by 2020 in the WECC beyond those already planned and committed. See Appendix F of the *Assumptions Book for ENERGY 2020* for the list of coal plants that are assumed to be planned and committed.
- Nuclear Plants: The cases assume no new nuclear plants to be built by 2020 in the WECC.
- Carbon capture and storage: Carbon capture and storage is assumed not feasible for electric power generation through 2020.
- Hydropower: The cases assume no new hydropower capacity built in the WECC by 2020.
- Plug-in hybrids: The cases assume that plug-in hybrid and electric vehicles are not available in significant numbers through 2020.
- Electrical Generation Costs: The modeling effort relies on estimates of power generation capital costs, operating costs, and heat rates developed for a recent study for the California Public utilities Commission (see Table B-4).
- Macroeconomic estimates: This phase of the analysis does not include macroeconomic analysis.

Table B-4: Summary of Power Generation Cost Inputs

Technology	Total Capital Costs $/kW	Fixed O&M ($/kW-yr)	Variable O&M ($/MWh)	Capacity Factor	Nominal Heat Rate
Biogas	$2,623	107.5	0.01	85%	11,566
Biomass	$3,836	50.18	2.96	85%	15,509
Geothermal	$3,575	154.92	-	90%	-
Hydro - Small	$2,530	13.14	3.3	50%	-
Solar - Thermal	$2,840	49.63	-	40%	-
Wind	$1,983	28.51	-	37%	-
Coal ST	$2,671	25.91	4.32	85%	8,844
Coal IGCC	$3,087	36.36	2.75	85%	8,309
Coal IGCC with CCS	$5,127	42.82	4.18	85%	9,713
Gas CCCT	$878	11.04	2.4	90%	6,917
Gas CT	$794	11.4	3.36	5%	10,807
Hydro - Large	$2,530	13.14	3.3	50%	-
Nuclear	$4,999	63.88	0.47	85%	10,400
<5MW CHP	$1,952	11.04	2.4	40.5%	9,700
>5MW CHP	$1,259	11.04	2.4	85%	9,220

Cost Basis Year = 2005. All estimates are 2008 U.S. dollars.
Source: E3 GHG Calculator v2b, tab "Gen Cost". Available at:
http://www.ethree.com/GHG/GHG%20Calculator%20v2b.zip

Outputs

The model results include estimates of energy use, GHG emissions, electricity generation, fuel prices, and costs. The following are brief explanations of the model results that are shown for the cases analyzed.

- Greenhouse Gas (GHG) Emissions: GHG emissions are presented in millions of metric tons of carbon dioxide equivalent ($MMTCO_2e$). Emissions for the eight WCI partner jurisdictions included in the analysis are presented by major sector.
- Compliance Summary: The Compliance Summary shows how GHG emissions are reduced to achieve the WCI partners' regional emissions goal of a 15% reduction from 2005 levels by 2020. The Compliance Summary shows a Compliance Total, which is the calculated emissions minus offsets used and adjusted for any allowances that are banked or that are used from the bank. The running total of emission allowances banked is also reported. The Compliance Total also considers changes in emissions in the non-WCI WECC power sector. The WCI cap-and-trade policies and complementary policies will affect GHG emissions from power generated in the non-WCI WECC states and provinces.

The change in these emissions are also included in the Compliance Total. To make this calculation, emissions associated with power imported into the WCI jurisdictions are estimated at 70 million tons per year. This estimate is preliminary, and is based on an assessment of recent power flows and emissions factors. Given the uncertainty in the estimate of these emissions, as well as the imperfect manner in which the First Jurisdictional Deliverer (FJD) policy is represented in the model, the reduction in emissions from the non-WCI WECC power sector counted toward the Compliance Total is limited to no more than 45 million tons in any year. Using this limit, the potential emission reduction from the non-WCI WECC power sector may be underestimated, thereby making the model evaluate a more stringent program than may be required in some cases. The Compliance Total is compared to 2006 emissions calculated in the model to estimate the emission reduction. In all the cases presented below, the compliance total shows approximately a 15% reduction in total economy wide emissions in 2020 relative to 2006. As discussed above, the estimates include only the eight WCI partner jurisdictions in the WECC.

- Total Energy Use: Total energy use is reported by fuel type and by major sector in units of TBtu/year.
- Electric Sector: Outputs for the electric sector include:
  - Generation Capacity in units of megaWatts (MW) by generation type. Note that estimated generation capacity grows due to capacity additions, but capacity retirement is not calculated. Consequently, generation capacity does not decline in the model outputs.
  - Generation Output in units of gigaWatt-hours per year (GWh/year) by generation type. The generation output is for the eight WCI partner jurisdictions in the WECC.
  - Electricity Sales in units of GWh/year, including electricity imports into the eight WCI partner jurisdictions in the WECC.
- Transportation Sector: Outputs for the transportation sector include vehicle miles traveled for passenger and freight vehicles, as well as miles traveled per passenger. The fleet average efficiency is reported for four vehicle types in miles per gallon.
- Fuel Prices: Fuel prices are reported for electricity, natural gas, coal, fuel oil, LPG, gasoline, and diesel in 2007 dollars per million Btu (2007 $/mmBtu). The prices include the forecasted energy prices (presented in Table B-3 above for the reference case and other tables below for the sensitivity cases) as well as the costs of delivering the fuels to market. The prices reported for the cap-and-trade policy cases also include the calculated allowance price, reflecting the appropriate carbon content of the fuel.
- Costs and Savings: Costs and savings are reported in millions of 2007 dollars per year ($M/Yr). Fuel Expenditures are reported by major sector, showing changes in expenditures from the Reference Case. These estimates of fuels expenditures do not include the value of the calculated allowance price, so a separate table of total allowance value is presented (equal to emissions times the allowance price). The allowance values reported by sector do not consider that the full allowance value may not be passed

through to consumers. Consequently, the allowance value by sector is reported as "potential" allowance value, recognizing that a portion of the allowance value may be borne by producers and not passed through to consumers. Total Costs are also reported by major sector, which are the sum of changes in fuel expenditures and changes in investment costs. Investment costs increase as more efficient devices, buildings, and processes are purchased in response to the limit on GHG emissions. The investment costs are annualized using a 5% real discount rate over the life of the equipment. The annualize costs are counted each year over the life of the equipment. The estimates of Total Costs include both the change in fuel expenditures and the change in investment costs. As shown in the tables below, the fuel expenditure savings typically offset most or all of the increased investment costs.

Results are shown only for the total of the eight WCI partners included in the analysis. State and province specific results are not included.

Reference Case

This section presents the results of the Reference Case. This case represents the future through 2020 in the absence of the WCI cap-and-trade program and related complementary GHG emission reduction policies. Table B-5 through Table B-10 show model outputs for:

- GHG emissions;
- energy use;
- electric sector results;
- transport sector results;
- fuel prices; and
- fuel expenditures.

Each table shows total results for the eight WCI Partners in the WECC. The three Canadian provinces not included in this analysis (Manitoba, Quebec, and Ontario) will be included in future modeling efforts.

Each table shows results for 2006 (the first year simulated by ENERGY 2020), 2010, 2015, and 2020. The growth rate reported for 2006-2020 is the average annual rate of exponential growth between the 2006 level and the 2020 level.

Table B-5: Reference Case Greenhouse Gas Emissions: Eight WCI Partners

GHG Emissions *(MMTCO2E)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	49.7	53.7	58.4	63.1	1.7%
Commercial	29.3	30.5	30.7	31.8	0.6%
Energy Intensive Industry	176.8	174.5	181.5	191.0	0.6%
Other Industry	29.8	30.3	30.5	31.0	0.3%
Passenger Transport	290.8	299.4	303.9	294.0	0.1%
Freight Transport	93.0	89.6	89.9	91.7	-0.1%
Power Sector	176.6	166.8	160.0	176.9	0.0%
Waste & Wastewater	25.6	29.1	34.2	38.4	2.9%
Agriculture (non-energy)	59.9	62.1	67.5	74.9	1.6%
Total	**931.6**	**936.1**	**956.6**	**992.8**	**0.5%**

Table B-6: Reference Case Energy Use: Eight WCI Partners

Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Aviation Fuel	609	637	683	725	1.3%
Biomass	443	429	453	493	0.8%
Coal	1,185	1,215	1,204	1,259	0.4%
Diesel	1,091	1,051	1,032	1,025	-0.4%
Ethanol	85	173	335	480	13.2%
Landfill Gas	29	29	29	29	0.2%
LPG	231	240	256	282	1.4%
Gasoline	3,303	3,313	3,256	3,053	-0.6%
Natural Gas	3,947	3,779	3,733	4,018	0.1%
Nuclear	658	658	658	658	0.0%
Oil, Unspecified	695	688	692	714	0.2%
Other	2,902	2,949	3,092	3,349	1.0%
Total	**15,178**	**15,161**	**15,422**	**16,086**	**0.4%**

Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	1,638	1,772	1,938	2,119	1.9%
Commercial	1,357	1,388	1,425	1,521	0.8%
Energy Intensive Industry	2,508	2,383	2,324	2,332	-0.5%
Other Industry	1,015	1,033	1,064	1,107	0.6%
Agriculture	140	127	114	104	-2.1%
Passenger Transportation	3,998	4,131	4,252	4,201	0.4%
Freight Transportation	1,219	1,183	1,208	1,251	0.2%
Waste & Wastewater	-	-	-	-	#N/A
Power Sector	3,302	3,143	3,097	3,450	0.3%
Total	**15,178**	**15,161**	**15,422**	**16,086**	**0.4%**

Table B-7: Reference Case Electric Sector Results: Eight WCI Partners

Generation Capacity *(MW)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	62,973	72,139	78,999	88,519	2.5%
Coal	14,972	15,372	15,372	15,372	0.2%
Nuclear	9,330	9,330	9,330	9,330	0.0%
Hydro	61,721	63,374	63,428	63,508	0.2%
Landfill Gas/EFW	338	347	347	347	0.2%
Wind	4,083	6,827	18,575	24,513	13.7%
Other	4,358	4,537	5,572	6,582	3.0%
Total	**157,776**	**171,925**	**191,623**	**208,172**	**2.0%**
Generation Output *(GWh/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	143,907	130,579	128,042	164,782	1.0%
Coal	99,280	100,482	98,019	101,454	0.2%
Nuclear	65,072	65,072	65,072	65,072	0.0%
Hydro	256,243	267,713	268,095	268,661	0.3%
Landfill Gas/EFW	2,036	2,088	2,088	2,088	0.2%
Wind	8,733	16,245	48,811	65,273	15.5%
Other	23,554	24,607	30,770	36,219	3.1%
Total	**598,824**	**606,784**	**640,897**	**703,548**	**1.2%**

Sales (GWh/year)	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	202,826	218,623	240,918	267,908	2.0%
Commercial	231,140	234,126	245,573	270,164	1.1%
Industrial	163,747	161,434	167,796	187,146	1.0%
Transportation	4,864	6,728	7,908	8,461	4.0%
Street Lights/Misc.	16,447	16,447	16,447	16,447	0.0%
Resale	-	-	-	-	#N/A
Total Sales	**619,023**	**637,357**	**678,642**	**750,126**	**1.4%**

Table B-8: Reference Case Transportation Sector Results: Eight WCI Partners

Distance Travelled (millions of vehicle miles travelled)					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Passenger	556,055	589,783	635,948	678,750	1.4%
Freight	72,562	73,248	77,423	82,189	0.9%
Passenger: Miles/person	8,755	8,781	8,847	8,844	0.1%
Vehicle Efficiency (miles/gallon)					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Light Gas Vehicles	23.2	24.1	25.5	28.5	1.5%
Medium Gas Vehicles	23.2	24.1	25.5	28.4	1.5%
Heavy Gas Vehicles	16.9	17.3	18.5	20.4	1.4%
Heavy Diesel Vehicles	16.9	17.3	18.4	20.3	1.3%
Vehicle efficiency represents a fleet-wide average, not the average for new vehicles.					

Table B-9: Reference Case Fuel Prices: Eight WCI Partners

Prices (2007 $/mmBtu)	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential					
Res Electricity Prices	29.4	30.9	29.8	30.1	0.2%
Res Natural Gas Prices	11.5	13.5	13.9	14.5	1.7%
Res Oil Prices	21.0	23.3	24.0	25.5	1.4%
Res LPG Prices	22.7	24.2	21.7	21.6	-0.3%
Commercial					
Com Electricity Prices	26.4	27.8	26.7	27.3	0.2%
Com Natural Gas Prices	8.8	10.0	9.8	10.1	1.0%
Com Oil Prices	23.1	25.0	24.0	24.6	0.4%
Com LPG Prices	22.5	24.3	21.7	21.4	-0.4%
Industrial					
Ind Electricity Prices	16.3	17.1	15.5	15.4	-0.4%
Ind Natural Gas Prices	6.7	7.3	6.4	6.3	-0.5%
Ind Coal Prices	2.2	2.2	2.1	2.1	-0.1%
Ind Oil Prices	16.4	18.4	19.2	20.7	1.7%
Ind LPG Prices	23.9	25.5	23.1	23.1	-0.2%
Transportation					
Gasoline Prices	21.9	24.1	26.0	28.0	1.8%
Diesel Prices	21.8	24.0	25.8	27.7	1.7%

Table B-10: Reference Case Fuel Expenditures: Eight WCI Partners

Annual Fuel Expenditures (Million$/Yr)					
Sector	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	31,763	37,523	40,670	45,609	2.6%
Commercial	28,452	31,306	31,632	35,373	1.6%
Energy Intensive Industry	28,969	31,248	30,889	32,725	0.9%
Other Industry	14,567	16,511	16,988	18,496	1.7%
Passenger Transportation	82,031	93,848	103,830	110,035	2.1%
Freight Transportation	28,315	30,055	32,280	35,567	1.6%
Agriculture	3,140	3,142	2,819	2,848	-0.7%
Total	**217,237**	**243,632**	**259,107**	**280,654**	**1.8%**

Cap-and-Trade Policy Cases

This section presents the results of three Cap-and-Trade Policy Cases:

- Broad Scope, with complementary policies and without offsets
- Broad Scope, with complementary policies and with offsets
- Narrow Scope, with complementary policies and with offsets

The narrow scope includes of the following:

- Electricity generation, including emissions from electricity imported into WCI jurisdictions from non-WCI jurisdictions
- Combustion at industrial and commercial facilities
- Industrial process emission sources, including oil and gas process emissions

The broad scope includes the emissions in the narrow scope plus the following:[10]

- Residential, commercial, and industrial fuel combustion at facilities with emissions below the WCI thresholds
- Transportation fuel combustion from gasoline and diesel

The banking of allowances is included in all three Policy Cases to simulate how allowances issued or auctioned in one year may be used in a later period. When allowance prices are low, allowances would likely be saved for use in a later year – which is referred to as being banked. When prices are high, allowances would be used from previous year, which is referred to as withdrawn from the bank. Attachment 1 explains how the model simulates banking and withdrawing of allowances.

Offsets are limited to 5% of the compliance obligation. The supply of offsets is modeled using an S-shaped curve that defines the portion of the offset limit that would be used as a function of allowance price. The analyses presented here limit the use of offsets to 5% of the annual compliance obligation, with an expected price of $20 per MTCO2e. Figure B-1 shows how the model simulates the use of offsets. At an allowance price of $20 per MTCO2e, approximately 58% of the offset limit is estimated to be used.

The Offsets Subcommittee is defining a process to develop offset supply curve data reflecting the availability and price of offsets under various offset policy assumptions. When available, those data would enable a more precise assessment to be conducted of the implications of policies that include offsets as a design feature.

The complementary policies have a substantial impact on the estimated emissions and costs. This analysis incorporates three broad sets of policies across all eight WCI partner jurisdictions in the analysis:

- Clean Car Standards, equivalent to California's Pavley I and II. These standards reduce emissions by about 30 MMTCO2E in 2020 compared to the Reference Case.

[10] For purposes of modeling the broad scope of the cap-and-trade program, the eight WCI partner jurisdictions included in the analysis are modeled with the broad scope starting in 2012. Note that British Columbia plans to use its carbon tax as an alternative policy for covering transportation fuels and residential/commercial fuels. This modeling effort, however, treats British Columbia the same as the other seven WCI partner jurisdictions included in the analysis.

- Programs that reduce total Vehicle Miles Traveled (VMT) by 2% from the forecast reference case by 2020. These programs reduce emissions by about 4 MMTCO2E when considered in addition to the Clean Car Standards.
- Aggressive energy efficiency programs that achieve a 1% reduction in the annual rate of electricity and natural gas demand growth. These programs reduce emissions by about 74 MMTCO2E in 2020 across all sectors.

We recognize that the WCI partner jurisdictions have climate action plans that reflect the specific opportunities and needs of the individual jurisdictions. In particular, they typically include policies that extend beyond the three included in this analysis. Based on the available time and resources for this study, as well as the focus on overall results for the WCI partner jurisdictions as a whole, the analysis is limited to reflecting these broad policies at this time.

By themselves the three complementary policies included in the analysis accomplish about 108 MMTCO2E of GHG reductions in 2020, which is about half of the reductions required from the Reference Case estimates in this analysis. Table B-11 shows the estimates for the transportation policies.

The complementary policies are modeled in conjunction with the cap-and-trade policies under the expectation that the cap-and-trade program can provide resources needed for supporting the VMT programs and the energy efficiency programs. In particular, the value of emission allowances (whether auctioned or provided for free) can be directed to support these programs.

Figure B-1: Assumed Offset Supply Curve

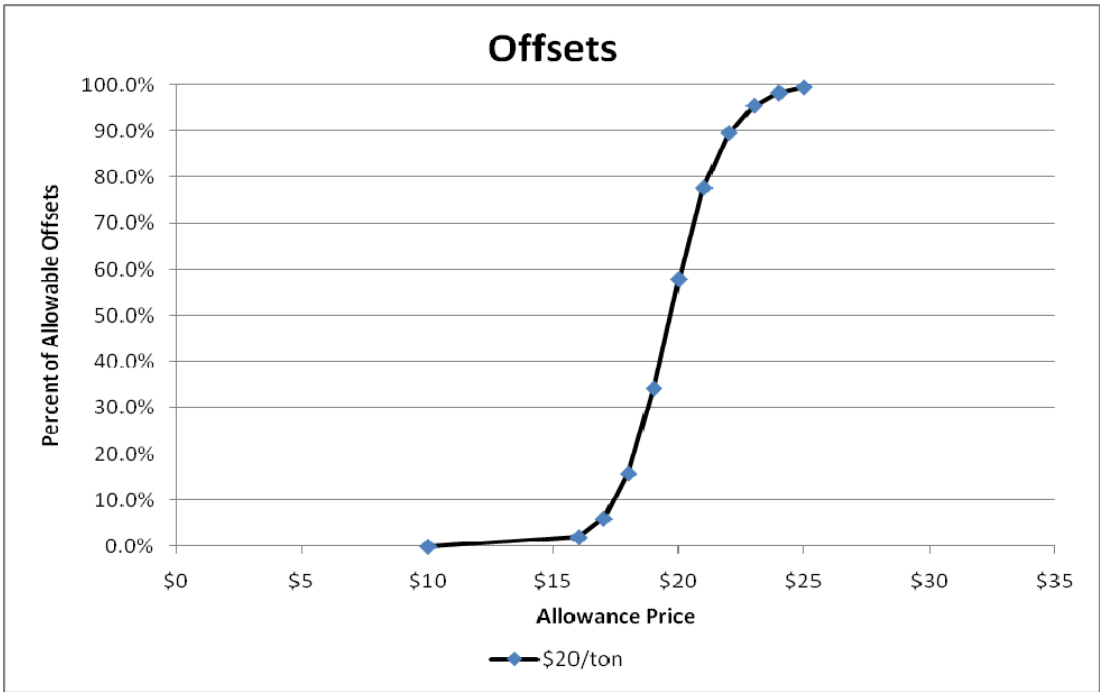


Table B-11: Impact of Transportation Complementary Policies in 2020 Compared to the Reference Case: Eight WCI Partners

	Clean Car Standards	Clean Car Standards and VMT Reduction
Change in GHG Emissions (million tons)	-30.1	-34.2
Change in Annual Vehicle Miles Traveled/Person	112	-65
Change in Annual Fuel Expenditures (million 2007$)	($11,943)	($13,549)
Change in Vehicle Capital Expenditures (million 2007$)	$10,325	($5,549)
Net Cost (Savings) (million 2007$)	($1,618)	($19,098)
Net cost does not include the cost of VMT Reduction programs.		

Table B-12 through Table B-19 show model outputs for these quantities:

- GHG emissions and compliance summary;
- energy use;
- electric sector results;
- transport sector results;
- fuel prices;
- fuel expenditures;
- potential allowance value; and
- costs.

Each table shows results for 2020 for eight WCI Partners, i.e., the seven states and British Columbia. As discussed above, the other three Canadian provinces will be included in future modeling efforts. For each policy case, the three columns indicate the Cap-and-Trade value for the quantity described in the left-most column, the difference between the Cap-and-Trade value and the Reference Case value, and the percentage difference between the two values.

Table B-16 shows fuel prices as a percent difference from Reference Case prices. Table B-19 shows the cost estimates, which only meaningful as incremental differences between the Cap-and-Trade value and the Reference Case value.

Table B-12: Cap-and-Trade Cases Greenhouse Gas Emissions and Compliance Summary: Eight WCI Partners

GHG Emissions in 2020 *(MMTCO2E)*	**Reference Case**	**Broad, Comp Policies No Offsets**			**Broad, Comp Policies With Offsets**			**Narrow, Comp Policies With Offsets**		
		Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff
Residential	63.1	55.0	-8.1	-12.8%	55.2	-7.9	-12.5%	55.9	-7.2	-11.4%
Commercial	31.8	26.2	-5.6	-17.5%	26.4	-5.4	-17.1%	27.0	-4.8	-15.0%
Energy Intensive Industry	191.0	174.5	-16.6	-8.7%	175.0	-16.0	-8.4%	172.6	-18.5	-9.7%
Other Industry	31.0	26.9	-4.2	-13.5%	27.0	-4.0	-12.9%	26.3	-4.8	-15.3%
Passenger Transport	294.0	258.7	-35.2	-12.0%	259.0	-34.9	-11.9%	259.9	-34.1	-11.6%
Freight Transport	91.7	89.9	-1.7	-1.9%	90.4	-1.3	-1.4%	91.7	0.0	0.0%
Power Sector	176.9	114.6	-62.2	-35.2%	131.5	-45.3	-25.6%	104.8	-72.1	-40.7%
Waste & Wastewater	38.4	38.4	0.0	0.0%	38.4	0.0	0.0%	38.4	0.0	0.0%
Agriculture (non-energy)	74.9	74.9	0.0	0.0%	74.9	0.0	0.0%	71.1	-3.7	-5.0%
WCI Sub-Total	**992.8**	**859.2**	**-133.6**	**-13.5%**	**877.9**	**-114.9**	**-11.6%**	**847.8**	**-145.0**	**-14.6%**
Non-WCI Power Sector	70.0	70.0			70.0			70.0		
Non-WCI Power Sector Reductions		-45.0			-37.0			-45.0		
Offsets		0.0			-31.8			-18.2		
Bank Flow		-31.1			-31.8			-0.2		
Compliance Total		**853.1**			**847.2**			**854.3**		
Percent of 2006 Emissions		85.2%			84.6%			85.3%		
Bank Inventory		72.6			74.4			0.5		
Allowance Price (2007 $/MT)		**$63**			**$24**			**$71**		
All emissions in millions of metric tons.										

Table B-13: Cap-and-Trade Cases Energy Use: Eight WCI Partners

	Reference Case	Broad, Comp Policies No Offsets			Broad, Comp Policies With Offsets			Narrow, Comp Policies With Offsets		
		Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff
Total Energy Use in 2020 *(TBtu/year)*										
Aviation Fuel	725	717.9	(7.4)	-1.0%	720	(5)	-0.7%	725	-	0.0%
Biomass	493	449	(44)	-8.9%	448	(45)	-9.1%	452	(41)	-8.3%
Coal	1,259	758	(502)	-39.8%	1,043	(217)	-17.2%	618	(642)	-50.9%
Diesel	1,025	995	(30)	-2.9%	1,001	(25)	-2.4%	1,014	(11)	-1.1%
Ethanol	480	421	(59)	-12.2%	420	(59)	-12.4%	419	(61)	-12.7%
Landfill Gas	29	29	(0)	0.0%	29	0	0.0%	29	(0)	0.0%
LPG	282	248	(33)	-11.8%	249	(32)	-11.5%	250	(32)	-11.3%
Gasoline	3,053	2,625	(429)	-14.0%	2,628	(426)	-13.9%	2,635	(418)	-13.7%
Natural Gas	4,018	3,245	(774)	-19.3%	3,075	(944)	-23.5%	3,296	(722)	-18.0%
Nuclear	658	658	-	0.0%	658	-	0.0%	658	-	0.0%
Oil, Unspecified	714	686	(27)	-3.8%	688	(26)	-3.6%	687	(27)	-3.8%
Other	3,349	2,956	(393)	-11.7%	2,952	(397)	-11.9%	2,934	(415)	-12.4%
Total	**16,086**	**13,788**	**(2,298)**	**-14.3%**	**13,911**	**(2,176)**	**-13.5%**	**13,718**	**(2,369)**	**-14.7%**
Total Energy Use in 2020 (Tbtu/year)										
Residential	2,119	1,853	(266)	-12.6%	1,856	(264)	-12.5%	1,863	(257)	-12.1%
Commercial	1,521	1,259	(262)	-17.2%	1,260	(261)	-17.2%	1,265	(256)	-16.8%
Energy Intensive Industry	2,332	2,029	(303)	-13.0%	2,035	(297)	-12.7%	2,005	(328)	-14.0%
Other Industry	1,107	1,001	(106)	-9.6%	1,003	(104)	-9.4%	991	(116)	-10.5%
Agriculture	104	93	(11)	-10.2%	94	(10)	-10.1%	92	(12)	-11.4%
Passenger Transportation	4,201	3,698	(503)	-12.0%	3,702	(499)	-11.9%	3,712	(489)	-11.6%
Freight Transportation	1,251	1,229	(22)	-1.8%	1,235	(16)	-1.3%	1,251	-	0.0%
Waste & Wastewater	-	-			-			-		
Power Sector	3,450	2,626	(824)	-23.9%	2,727	(724)	-21.0%	2,539	(912)	-26.4%
Total	**16,086**	**13,788**	**(2,298)**	**-14.3%**	**13,911**	**(2,176)**	**-13.5%**	**13,718**	**(2,369)**	**-14.7%**

Table B-14: Cap-and-Trade Cases Electric Sector Results: Eight WCI Partners

	Reference Case	Broad, Comp Policies No Offsets			Broad, Comp Policies With Offsets			Narrow, Comp Policies With Offsets		
		Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff
Generation Capacity in 2020 *(MW)*										
Gas/Oil	88,519	109,759	21,240	24.0%	109,919	21,400	24.2%	109,879	21,360	24.1%
Coal	15,372	15,372	-	0.0%	15,372	-	0.0%	15,372	-	0.0%
Nuclear	9,330	9,330	-	0.0%	9,330	-	0.0%	9,330	-	0.0%
Hydro	63,508	63,471	(37)	-0.1%	63,471	(37)	-0.1%	63,462	(46)	-0.1%
Landfill Gas/EFW	347	347	-	0.0%	347	-	0.0%	347	-	0.0%
Wind	24,513	22,943	(1,570)	-6.4%	22,945	(1,569)	-6.4%	22,721	(1,792)	-7.3%
Other	6,582	6,354	(228)	-3.5%	6,354	(228)	-3.5%	6,344	(238)	-3.6%
Total	**208,172**	**227,576**	**19,405**	**9.3%**	**227,738**	**19,566**	**9.4%**	**227,456**	**19,284**	**9.3%**
Generation Output 2020 *(GWh/year)*										
Gas/Oil	164,782	127,711	(37,072)	-22.5%	101,382	(63,400)	-38.5%	134,044	(30,738)	-18.7%
Coal	101,454	58,979	(42,474)	-41.9%	85,318	(16,136)	-15.9%	46,848	(54,606)	-53.8%
Nuclear	65,072	65,072	-	0.0%	65,072	-	0.0%	65,072	-	0.0%
Hydro	268,661	268,398	(263)	-0.1%	268,398	(263)	-0.1%	268,337	(324)	-0.1%
Landfill Gas/EFW	2,088	2,088	(0)	0.0%	2,088	0	0.0%	2,088	(0)	0.0%
Wind	65,273	60,920	(4,353)	-6.7%	60,925	(4,348)	-6.7%	60,305	(4,968)	-7.6%
Other	36,219	34,579	(1,640)	-4.5%	34,579	(1,640)	-4.5%	34,558	(1,661)	-4.6%
Total	**703,548**	**617,746**	**(85,803)**	**-12.2%**	**617,761**	**(85,788)**	**-12.2%**	**611,251**	**(92,297)**	**-13.1%**
Sales in 2020 *(GWh/year)*										
Residential	267,908	232,745	(35,163)	-13.1%	232,447	(35,462)	-13.2%	230,725	(37,183)	-13.9%
Commercial	270,164	223,406	(46,758)	-17.3%	222,998	(47,166)	-17.5%	221,170	(48,994)	-18.1%
Industrial	187,146	162,812	(24,333)	-13.0%	162,071	(25,075)	-13.4%	162,118	(25,027)	-13.4%
Transportation	8,461	8,268	(193)	-2.3%	8,229	(232)	-2.7%	7,923	(538)	-6.4%
Street Lights/Misc.	16,447	16,447	-	0.0%	16,447	-	0.0%	16,447	-	0.0%
Total Sales	**750,126**	**643,678**	**(106,447)**	**-14.2%**	**642,191**	**(107,935)**	**-14.4%**	**638,383**	**(111,743)**	**-14.9%**

Table B-15: Cap-and-Trade Cases Transportation Sector Results: Eight WCI Partners

	Reference Case	Broad, Comp Policies No Offsets			Broad, Comp Policies With Offsets			Narrow, Comp Policies With Offsets		
		Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff
Distance Travelled in 2020 *(millions of vehicle miles travelled)*										
Passenger	678,750	672,238	(6,512)	-1.0%	672,665	(6,085)	-0.9%	673,720	(5,031)	-0.7%
Freight	82,189	81,516	(673)	-0.8%	81,715	(474)	-0.6%	82,189	-	0.0%
Passenger: Miles/person	8,844	8,759	(85)	-1.0%	8,765	(79)	-0.9%	8,778	(66)	-0.7%
Vehicle Efficiency in 2020 *(miles/gallon)*										
Light Gas Vehicles	28.5	33	4	15.3%	33	4	15.4%	33	4	15.3%
Medium Gas Vehicles	28.4	33	4	15.3%	33	4	15.3%	33	4	15.3%
Heavy Gas Vehicles	20.4	24	4	17.4%	24	4	17.5%	24	4	17.5%
Heavy Diesel Vehicles	20.3	24	4	17.5%	24	4	17.5%	24	4	17.5%
Vehicle efficiency represents a fleet-wide average, not the average for new vehicles.										

Table B-16: Cap-and-Trade Cases Fuel Price Results: Eight WCI Partners

Prices in 2020 (2007 $/mmBtu)	**Reference Case**	**Broad, Comp Policies No Offsets**	**Broad, Comp Policies With Offsets**	**Narrow, Comp Policies With Offsets**
	Price	Percent Diff	Percent Diff	Percent Diff
Residential				
Res Electricity Prices	30.1	-0.3%	1.0%	12.7%
Res Natural Gas Prices	14.5	31.4%	12.2%	1.0%
Res Oil Prices	25.5	20.4%	7.7%	-0.1%
Res LPG Prices	21.6	14.6%	5.6%	0.0%
Commercial				
Com Electricity Prices	27.3	-2.4%	-0.2%	14.3%
Com Natural Gas Prices	10.1	23.7%	7.9%	-1.0%
Com Oil Prices	24.6	4.9%	2.1%	0.4%
Com LPG Prices	21.4	9.2%	4.4%	1.3%
Industrial				
Ind Electricity Prices	15.4	4.7%	6.6%	35.6%
Ind Natural Gas Prices	6.3	19.2%	7.1%	20.2%
Ind Coal Prices	2.1	167.4%	64.3%	182.4%
Ind Oil Prices	20.7	17.2%	6.5%	19.4%
Ind LPG Prices	23.1	6.2%	2.9%	7.0%
Transportation				
Gasoline Prices	28.0	17.4%	6.6%	0.0%
Diesel Prices	27.7	16.8%	6.4%	0.0%

Table B-17: Cap-and-Trade Cases Fuel Expenditure Results: Eight WCI Partners

Annual Fuel Expenditures in 2020 (M$/Yr)	Reference Case	Broad, Comp Policies No Offsets			Broad, Comp Policies With Offsets			Narrow, Comp Policies With Offsets		
		Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff	Value	Diff from Reference	Percent Diff
Sector										
Residential	45,609	39,918	(5,691)	-12.5%	40,244	(5,365)	-11.8%	43,138	(2,471)	-5.4%
Commercial	35,373	28,861	(6,512)	-18.4%	29,356	(6,017)	-17.0%	32,098	(3,275)	-9.3%
Energy Intensive Industry	32,725	29,018	(3,707)	-11.3%	29,119	(3,606)	-11.0%	29,831	(2,894)	-8.8%
Other Industry	18,496	17,001	(1,495)	-8.1%	17,062	(1,434)	-7.8%	17,977	(519)	-2.8%
Passenger Transportation	110,035	96,146	(13,889)	-12.6%	96,251	(13,784)	-12.5%	96,577	(13,458)	-12.2%
Freight Transportation	35,567	34,932	(636)	-1.8%	35,111	(457)	-1.3%	35,568	0	0.0%
Agriculture	2,848	2,482	(366)	-12.8%	2,499	(349)	-12.2%	2,669	(178)	-6.3%
Total	**280,654**	**248,358**	**(32,296)**	**-11.5%**	**249,641**	**(31,012)**	**-11.0%**	**257,859**	**(22,794)**	**-8.1%**

Table B-18: Cap-and-Trade Program Potential Allowance Value: Eight WCI Partners

Allowance Value in 2020 (M$)	Broad, Comp Policies No Offsets	Broad, Comp Policies With Offsets	Narrow, Comp Policies With Offsets
	Diff from Reference	Diff from Reference	Diff from Reference
Sector			
Residential	$3,445	$1,321	$0
Commercial	$1,641	$631	$1,925
Energy Intensive Industry	$10,922	$4,188	$12,293
Other Industry	$1,681	$647	$1,873
Passenger Transportation	$16,197	$6,199	$0
Freight Transportation	$5,630	$2,164	$0
Agriculture	$0	$0	$0
Total	**39,516**	**15,150**	**16,092**

Potential allowance value is calculated as the allowance price times the emissions in the sector. The full allowance value may not be incurred in each sector depending on the manner in which allowances are distributed and the ability to pass allowance costs to customers.

Table B-19: Cap-and-Trade Cases Cost Results: Eight WCI Partners

Annualized Costs in 2020 (M$/Yr)	Broad, Comp Policies No Offsets	Broad, Comp Policies With Offsets	Narrow, Comp Policies With Offsets
	Diff from Reference	Diff from Reference	Diff from Reference
Sector			
Residential	(6,443)	(6,158)	(3,327)
Commercial	(7,845)	(7,369)	(4,760)
Energy Intensive Industry	10,935	10,908	12,674
Other Industry	1,979	1,996	3,250
Passenger Transportation	(20,988)	(20,511)	(19,005)
Freight Transportation	(722)	(522)	0
Agriculture	(442)	(425)	(254)
Total	**(23,525)**	**(22,080)**	**(11,422)**

These costs do not include costs of VMT Reduction programs, Energy Efficiency programs, nor Potential Allowance Value.

Sensitivity Cases

This section presents the results of three sensitivity cases. These cases consider alternatives to the energy prices and generation costs assumed in the Reference Case. The cases discussed here are:

- High Energy Prices and High Generation Costs
- Low Energy Price Case
- High Natural Gas Price Case

Other cases are also of interest, but time did not allow for development of input data for them to be modeled in a meaningful way.

For the first two of these sensitivity cases, it was necessary to produce a new Reference Case as well as a policy case. In these cases the policy is compared to its appropriate sensitivity Reference Case.

For all the sensitivity cases, the WCI policy case is for the broad scope with offsets. The sensitivities are variations of the assumptions embedded in the Reference Case, not variations of cap-and-trade policy design.

High Energy Prices and High Generation Costs

The purpose of this sensitivity is to examine the implications of energy prices being higher than assumed in the Reference Case. There has been considerable stakeholder comment that the energy prices in the Reference Case may be too low. Additionally, some stakeholders have commented that the power generation cost assumptions maybe too low, indicating that the recent increases in commodity prices have had an impact on these costs.

This sensitivity includes both increased energy prices and increased power generation costs as a set of conditions that could occur together in the future. The high energy cost case assumes that energy prices start at current 2008 prices and increase in real terms by 50% by 2020, as shown in Table B-20. The high power generation cost case assumes that capital and operation and maintenance (O&M) costs are 30% higher than in the Reference Case.

Table B-20: Fuel Price Forecast:
High Energy Prices and High Generation Costs Sensitivity Case

	2006	2010	2015	2020
World Oil Price (2007 US$/barrel)	64.21	120.37	143.52	166.67
Natural Gas Wellhead Price (2007 US$/mmBtu)	5.97	11.12	13.26	15.40
Coal Prices (2007 US$/ton)	28.98	41.47	48.52	55.90

Low Energy Price Case

The purpose of this sensitivity is to examine the implications of energy prices being lower than assumed in the Reference Case. While there has not been stakeholder comment suggesting that energy prices may be lower, it is prudent to examine the implications of

lower prices. The low energy price case uses the mid-price case from the Annual Energy Outlook 2008 (Table B-21).

Table B-21: Fuel Price Forecast: Low Energy Price Sensitivity Case

	2006	2010	2015	2020
World Oil Price (2007 US$/barrel)	$64.21	$71.60	$57.88	$57.74
Natural Gas Wellhead Price (2007 US$/mmBtu)	$5.97	$7.11	$6.09	$6.25
Coal Prices (2007 US$/ton)	$25.37	$26.66	$23.53	$22.33
Source: EIA Annual Energy Outlook 2008 mid-price series.				

High Natural Gas Price Case

The purpose of this sensitivity is to examine the implications of natural gas prices being higher than assumed in the Reference Case. There has been considerable stakeholder comment that efforts to reduce GHG emissions may increase the demand for natural gas. Consequently, the price of natural gas may increase as a result of the policies that are implemented to reduce emissions.

In the cases examined above, the demand for natural gas declines overall as a result of the complementary policies and the cap-and-trade program. Consequently, the policies examined in this analysis would not be expected to lead to an increase in natural gas prices. Nevertheless, this sensitivity was performed to examined the implications of higher natural gas prices.

To perform this sensitivity, the high natural gas price shown in Table B-20 was used with the cap-and-trade policy. The results were compared to the original Reference Case with the Reference Case natural gas prices. So, the natural gas prices are higher in the cap-and-trade case than in the Reference Case.

Results

Table B-22 through Table B-29 show model outputs for 2020: Each table shows results for eight WCI Partners, i.e., the seven states and British Columbia. The other three provinces will be included in future modeling efforts.

For each policy case, the three columns indicate the relevant Reference Case value (because each policy case has a different Reference Case), Cap-and-Trade value for the quantity described in the left-most column, and the difference between the Cap-and-Trade value and its Reference value.

Table B-26 shows fuel prices as a percent difference from Reference prices. Table B-29 shows the costs, which are only meaningful as incremental differences between the Cap-and-Trade value and the appropriate Reference Case.

Table B-22: Sensitivity Cases Greenhouse Gas Emissions and Compliance Summary: Eight WCI Partners

GHG Emissions in 2020 *(MMTCO2E)*	**Original Reference Case**	**High Energy Prices & Generation Costs**			**Low Energy Prices**			**High Natural Gas Prices**		
		Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff
Residential	63.1	58.5	52.2	-6.3	63.9	55.1	-8.7	63.1	51.9	-11.2
Commercial	31.8	28.0	23.9	-4.1	32.1	26.2	-5.9	31.8	23.7	-8.1
Energy Intensive Industry	191.0	182.4	170.0	-12.4	193.4	174.6	-18.8	191.0	174.5	-16.6
Other Industry	31.0	28.0	25.0	-3.0	31.9	27.0	-4.9	31.0	25.7	-5.4
Passenger Transport	294.0	276.0	244.1	-31.9	299.6	262.4	-37.2	294.0	259.1	-34.9
Freight Transport	91.7	79.0	78.5	-0.5	100.2	95.9	-4.3	91.7	90.7	-1.0
Power Sector	176.9	166.5	126.2	-40.3	177.1	102.4	-74.7	176.9	126.6	-50.2
Waste & Wastewater	38.4	38.4	38.4	0.0	38.4	38.4	0.0	38.4	38.4	0.0
Agriculture (non-energy)	74.9	74.9	74.9	0.0	74.9	74.9	0.0	74.9	74.9	0.0
WCI Sub-Total	**992.8**	**931.8**	**833.3**	**-98.6**	**1011.4**	**857.0**	**-154.5**	**992.8**	**865.4**	**-127.4**
Non-WCI Power Sector	70.0	70.0	70.0	-	70.0	70.0	-	70.0	70.0	-
Non-WCI Power Sector Reductions			(42.4)			(45.0)			(45.0)	
Offsets			(12.7)			(34.1)			(26.6)	
Bank Flow			-0.2			-0.1			-11.7	
Compliance Total			**847.9**			**847.8**			**852.1**	
Percent of 2006 Emissions			*84.7%*			*84.6%*			*85.1%*	
Bank Inventory			30.8			0.1			168.4	
Allowance Price (2007 $/MT)			**$18**			**$56**			**$20**	
All emissions in millions of metric tons.										

Table B-23: Sensitivity Cases Energy Use Results: Eight WCI Partners

	Original Reference Case	High Energy Prices & Generation Costs			Low Energy Prices			High Natural Gas Prices		
		Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff
Total Energy Use in 2020 (TBtu/year)										
Aviation Fuel	725	680	678	(2)	753	738	(15)	725	721	(4)
Biomass	493	528	469	(59)	495	448	(47)	493	456	(37)
Coal	1,259	1,223	1,055	(168)	1,252	609	(642)	1,259	1,100	(160)
Diesel	1,025	876	861	(15)	1,126	1,067	(59)	1,025	1,004	(21)
Ethanol	480	509	445	(64)	466	412	(55)	480	420	(60)
Landfill Gas	29	29	29	0	29	29	(0)	29	29	(0)
LPG	282	332	285	(47)	271	243	(28)	282	273	(9)
Gasoline	3,053	2,824	2,439	(385)	3,120	2,666	(454)	3,053	2,631	(423)
Natural Gas	4,018	3,478	2,687	(791)	4,065	3,252	(813)	4,018	2,641	(1,378)
Nuclear	658	658	658	-	658	658	-	658	658	-
Oil, Unspecified	714	681	662	(19)	757	714	(43)	714	706	(7)
Other	3,349	3,347	2,987	(360)	3,347	2,943	(404)	3,349	3,017	(332)
Total	**16,086**	**15,164**	**13,255**	**(1,909)**	**16,340**	**13,780**	**(2,560)**	**16,086**	**13,656**	**(2,431)**
Total Energy Use in 2020 (TBtu/year)										
Residential	2,119	2,028	1,802	(226)	2,135	1,854	(281)	2,119	1,803	(316)
Commercial	1,521	1,453	1,231	(222)	1,530	1,261	(269)	1,521	1,233	(288)
Energy Intensive Industry	2,332	2,205	1,963	(242)	2,361	2,029	(332)	2,332	2,004	(328)
Other Industry	1,107	1,050	968	(82)	1,118	1,000	(118)	1,107	976	(131)
Agriculture	104	95	88	(8)	108	95	(13)	104	91	(13)
Passenger Transportation	4,201	3,960	3,500	(460)	4,274	3,745	(530)	4,201	3,699	(502)
Freight Transportation	1,251	1,092	1,085	(6)	1,360	1,305	(55)	1,251	1,238	(13)
Waste & Wastewater	-	-	-	-	-	-	-	-	-	-
Power Sector	3,450	3,281	2,618	(664)	3,454	2,492	(962)	3,450	2,610	(840)
Total	**16,086**	**15,164**	**13,255**	**(1,909)**	**16,340**	**13,780**	**(2,560)**	**16,086**	**13,656**	**(2,431)**

Table B-24: Sensitivity Cases Electric Sector Results: Eight WCI Partners

	Original Reference Case	High Energy Prices & Generation Costs			Low Energy Prices			High Natural Gas Prices		
		Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff
Generation Capacity in 2020 *(MW)*										
Gas/Oil	88,519	89,519	106,599	17,080	86,239	108,759	22,520	88,519	136,359	47,840
Coal	15,372	15,372	15,372	-	15,372	15,372	-	15,372	15,372	-
Nuclear	9,330	9,330	9,330	-	9,330	9,330	-	9,330	9,330	-
Hydro	63,508	63,914	63,426	(488)	63,507	63,464	(43)	63,508	63,397	(111)
Landfill Gas/EFW	347	347	347	-	347	347	-	347	347	-
Wind	24,513	22,766	21,533	(1,233)	24,290	22,829	(1,461)	24,513	23,967	(546)
Other	6,582	6,695	6,330	(365)	6,646	6,384	(262)	6,582	6,343	(239)
Total	**208,172**	**207,943**	**222,938**	**14,995**	**205,731**	**226,485**	**20,754**	**208,172**	**255,115**	**46,943**
Generation Output 2020 *(GWh/year)*										
Gas/Oil	164,782	145,539	81,131	(64,407)	162,219	128,052	(34,167)	164,782	84,935	(79,847)
Coal	101,454	101,513	88,202	(13,312)	101,389	46,101	(55,288)	101,454	88,847	(12,606)
Nuclear	65,072	65,072	65,072	-	65,072	65,072	-	65,072	65,072	-
Hydro	268,661	271,519	268,082	(3,437)	268,649	268,349	(300)	268,661	267,877	(784)
Landfill Gas/EFW	2,088	2,088	2,088	0	2,088	2,088	(0)	2,088	2,088	(0)
Wind	65,273	60,428	57,011	(3,417)	64,654	60,603	(4,051)	65,273	63,758	(1,515)
Other	36,219	36,501	34,019	(2,482)	36,886	34,499	(2,387)	36,219	32,919	(3,299)
Total	**703,548**	**682,659**	**595,605**	**(87,055)**	**700,956**	**604,763**	**(96,193)**	**703,548**	**605,496**	**(98,052)**
Sales in 2020 *(GWh/year)*										
Residential	267,908	267,531	233,815	(33,717)	267,625	232,186	(35,439)	267,908	235,623	(32,286)
Commercial	270,164	272,103	227,845	(44,257)	268,841	222,860	(45,980)	270,164	228,621	(41,542)
Industrial	187,146	186,028	163,446	(22,582)	185,238	160,256	(24,983)	187,146	164,351	(22,795)
Transportation	8,461	7,533	7,413	(120)	8,537	8,071	(465)	8,461	7,458	(1,003)
Street Lights/Misc.	16,447	16,447	16,447	-	16,447	16,447	-	16,447	16,447	-
Total Sales	**750,126**	**749,642**	**648,966**	**(100,676)**	**746,687**	**639,820**	**(106,867)**	**750,126**	**652,500**	**(97,625)**

Table B-25: Sensitivity Cases Transportation Sector Results: Eight WCI Partners

	Original Reference Case	High Energy Prices & Generation Costs			Low Energy Prices			High Natural Gas Prices		
		Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff
Distance Travelled in 2020 *(millions of vehicle miles travelled)*										
Passenger	678,750	663,044	659,404	(3,640)	686,691	677,633	(9,058)	678,750	672,895	(5,855)
Freight	82,189	77,505	77,301	(205)	85,286	83,768	(1,518)	82,189	81,805	(384)
Passenger: Miles/person	8,844	8,639	8,592	(47)	8,948	8,829	(118)	8,844	8,768	(76)
Vehicle Efficiency in 2020 *(miles/gallon)*										
Light Gas Vehicles	28.5	30.2	34.9	4.7	28.4	32.8	4.3	28.5	32.8	4.4
Medium Gas Vehicles	28.4	30.2	34.9	4.7	28.4	32.7	4.3	28.4	32.8	4.4
Heavy Gas Vehicles	20.4	20.6	24.2	3.6	20.5	24.0	3.6	20.4	24.0	3.6
Heavy Diesel Vehicles	20.3	20.4	24.0	3.6	20.3	23.9	3.6	20.3	23.9	3.5
Vehicle efficiency represents a fleet-wide average, not the average for new vehicles.										

Table B-26: Sensitivity Cases Fuel Price Results: Eight WCI Partners

Prices in 2020 (2007 $/mmBtu)	High Energy Prices & Generation Costs		Low Energy Prices		High Natural Gas Prices	
	Ref Price	Percent Diff	Ref Price	Percent Diff	Ref Price	Percent Diff
Residential						
Res Electricity Prices	37.5	-4%	29.0	10%	30.1	12%
Res Natural Gas Prices	22.8	6%	13.4	31%	14.5	68%
Res Oil Prices	40.0	4%	19.9	23%	25.5	6%
Res LPG Prices	21.7	4%	21.6	13%	21.6	5%
Commercial						
Com Electricity Prices	34.8	-4%	26.2	11%	27.3	11%
Com Natural Gas Prices	19.0	4%	9.4	23%	10.1	96%
Com Oil Prices	43.3	1%	22.5	7%	24.6	2%
Com LPG Prices	22.2	3%	21.6	8%	21.4	7%
Industrial						
Ind Electricity Prices	22.9	-2%	14.6	28%	15.4	28%
Ind Natural Gas Prices	16.4	2%	5.9	17%	6.3	169%
Ind Coal Prices	5.1	20%	2.1	148%	2.1	52%
Ind Oil Prices	35.0	3%	15.0	21%	20.7	4%
Ind LPG Prices	23.5	2%	23.2	6%	23.1	4%
Transportation						
Gasoline Prices	40.7	3%	20.7	21%	28.0	6%
Diesel Prices	40.6	3%	20.6	20%	27.7	5%

Table B-27: Sensitivity Cases Fuel Expenditure Results: Eight WCI Partners

Annual Fuel Expenditures in 2020 (M$/Yr)	**Original Reference Case**	**High Energy Prices & Generation Costs**			**Low Energy Prices**			**High Natural Gas Prices**		
		Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff	Ref Case	Cap-Trade Case	Diff
Sector										
Residential	45,609	59,685	51,704	(7,981)	43,546	40,351	(3,195)	45,609	49,857	4,247
Commercial	35,373	46,310	37,665	(8,646)	33,624	29,954	(3,670)	35,373	35,121	(252)
Energy Intensive Industry	32,725	45,447	40,833	(4,614)	28,528	25,567	(2,961)	32,725	34,487	1,762
Other Industry	18,496	26,917	24,680	(2,237)	15,624	14,919	(705)	18,496	19,811	1,315
Passenger Transportation	110,035	153,023	134,505	(18,518)	82,147	71,469	(10,677)	110,035	96,875	(13,160)
Freight Transportation	35,567	45,436	45,174	(262)	29,929	28,755	(1,174)	35,567	35,199	(369)
Agriculture	2,848	3,807	3,328	(478)	2,564	2,349	(216)	2,848	2,779	(69)
Total	**280,654**	380,625	337,889	(42,736)	235,962	213,364	(22,598)	280,654	274,129	(6,525)

Table B-28: Sensitivity Cases Potential Allowance Value: Eight WCI Partners

Allowance Value in 2020 (M$)	High Energy Prices & Generation Costs	Low Energy Prices	High Natural Gas Prices
	Diff from Reference	Diff from Reference	Diff from Reference
Sector			
Residential	$925	$3,064	$1,031
Commercial	$424	$1,456	$471
Energy Intensive Industry	$3,013	$9,705	$3,468
Other Industry	$443	$1,502	$510
Passenger Transportation	$4,325	$14,584	$5,150
Freight Transportation	$1,391	$5,332	$1,802
Agriculture	$0	$0	$0
Total	**10,521**	**35,642**	**12,434**

Potential allowance value is calculated as the allowance price times the emissions in the sector. The full allowance value may not be incurred in each sector depending on the manner in which allowances are distributed and the ability to pass allowance costs to customers.

Table B-29: Sensitivity Cases Cost Results: Eight WCI Partners

Annualized Costs in 2020 (M$/Yr)	High Energy Prices & Generation Costs	Low Energy Prices	High Natural Gas Prices
	Diff from Reference	Diff from Reference	Diff from Reference
Sector			
Residential	($9,724)	($3,749)	$4,833
Commercial	($12,158)	($4,120)	($1,394)
Energy Intensive Industry	$12,294	$11,335	$18,778
Other Industry	$1,917	$2,782	$5,806
Passenger Transportation	($21,999)	($20,845)	($19,589)
Freight Transportation	($298)	($1,362)	($423)
Agriculture	($546)	($287)	($131)
Total	**($30,514)**	**($16,245)**	**$7,880**

These costs do not include costs of VMT Reduction programs, Energy Efficiency programs, nor Potential Allowance Value.

Summary Results

Table B-30 presents summary results for the cases presented above. The GHG emissions are reported for the eight WCI partner jurisdictions included in the analysis. Fuel Expenditures and Total Costs (Savings) are relative to the appropriate Reference Case. The potential value of allowances is shown assuming that the full allowance value is passed through to consumers. Total Costs (Savings) include Fuel Expenditures and annualized investment costs. All emissions are in MMTCO2E and all costs are in 2007 dollars.

Table B-30: Summary Results for 2020: Eight WCI Partners

Case	GHG Emission (MMTCO2E)	Offsets Used (MMTCO2E)	Allowance Price (2007 $)	Change in Fuel Expenditures ($M/Yr)	Potential Allowance Value ($M/Yr)	Total Costs (Savings) ($M/Yr)
Reference Case	992.8	--	--	--	--	--
Cap-and-Trade Policy Cases						
Broad Scope, No Offsets	859.2	--	$63	(32,296)	39,516	(23,525)
Broad Scope, With Offsets	877.9	31.8	$24	(31,012)	15,150	(22,080)
Narrow Scope, With Offsets	847.8	18.2	$71	(22,794)	16,092	(11,422)
Sensitivity Cases						
High Price	833.3	12.7	$18	(42,736)	10,521	($30,514)
Low Price	857.0	34.1	$56	(22,598)	35,642	($16,245)
High Natural Gas Price	865.4	26.6	$20	(6,525)	12,434	$7,880

Fuel Expenditures and Total Costs (Savings) are changes from Reference Case values.
Potential Allowance Value calculated as emissions times allowance price.
Total Costs (Savings) do not include costs of VMT Reduction programs, Energy Efficiency programs, nor Potential Allowance Value.

Attachment 1: Banking

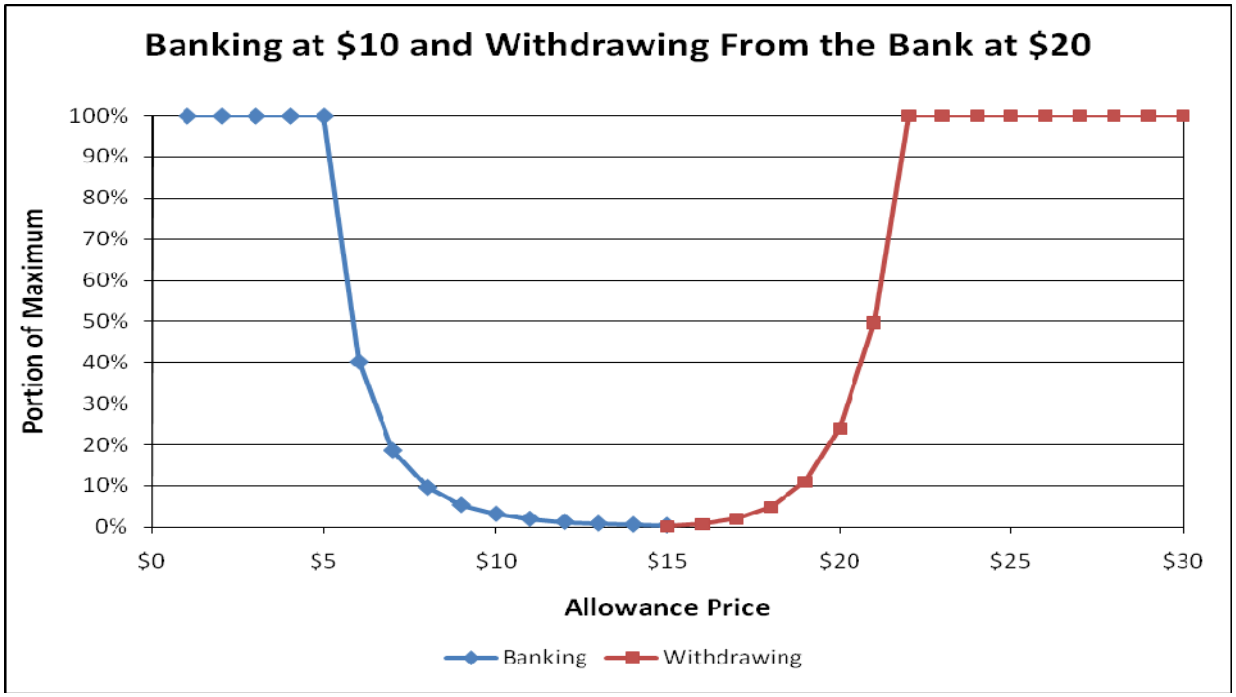
The purpose of banking is to enable allowances issued or auctioned in one year to be used in a later period. When allowance prices are low, allowances would likely be banked. When prices are high, allowances would be withdrawn from the bank. The model does not have the ability to optimize the banking behaviour in the market. Rather, banking is simulated using the following model input parameters:

- The price below which allowances are put into the bank.
- The maximum portion of emission allowances in a given year that can be banked.
- The price above which allowances are withdrawn from the bank.
- The maximum portion of the allowances in the bank in a given year that can be withdrawn.

Figure A-2 shows the banking and withdrawing curves used the cases presented here. The curves shown in the figure set the price below which allowances are banked at $10/ton. The price above which allowances are withdrawn from the bank is set at $20/ton.

The curves in the figure indicate the portion of the allowable banking and redeeming amounts that are simulated to be used. The recommended program design sets no limits on the amounts that can be banked. However, bounds are set in the model to better simulate behavior, particularly in the early years of the program when allowances prices are simulated to be low. The maximum amount put into the bank in a single year is limited to 10% of total allowances available in that year. The maximum amount withdrawn from the bank in a single year is limited to 30% of the allowances in the bank.

Figure B-2: Banking Curves



Attachment 2: Detailed Cap-and-Trade Policy Results

This attachment shows the detailed results for two of the cap-and-trade program model runs:

- Broad Scope, with complementary policies and with offsets; and
- Narrow Scope, with complementary policies and with offsets.

Cap-and-Trade Program: Broad Scope with Complementary Policies and Offsets

Table B-31: Cap-and-Trade Program Greenhouse Gas Emissions and Compliance Summary: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

	2006	2010	2015	2020	Growth Rate 2006-2020
GHG Emissions *(MMTCO2E)*					
Residential	49.7	53.6	54.7	55.2	0.8%
Commercial	29.3	30.4	28.0	26.4	-0.8%
Energy Intensive Industry	176.8	174.0	172.2	175.0	-0.1%
Other Industry	29.8	30.2	28.5	27.0	-0.7%
Passenger Transport	290.8	291.7	276.5	259.0	-0.8%
Freight Transport	93.0	89.6	89.6	90.4	-0.2%
Power Sector	176.6	166.4	133.0	131.5	-2.1%
Waste & Wastewater	25.6	29.1	34.2	38.4	2.9%
Agriculture (non-energy)	59.9	62.1	67.5	74.9	1.6%
WCI Sub-Total	**931.6**	**927.1**	**884.1**	**877.9**	**-0.4%**
Compliance Summary					
Non-WCI Power Sector	70.0	70.0	70.0	70.0	
Non-WCI Power Sector Reductions	-	(0.1)	(20.3)	(37.0)	
Offsets	-	-	-	(31.8)	
Bank Flow	0.0	0.0	21.2	-31.8	
Compliance Total	**1,001.6**	**997.0**	**955.0**	**847.2**	
Percent of 2006 Emissions	*100.0%*	*99.5%*	*95.3%*	*84.6%*	
Bank Inventory	0.0	0.0	107.4	74.4	
Allowance Price (2007 $/MT)	**$0**	**$0**	**$6**	**$24**	
Percentage of Offsets Allowed	5%	5%	5%	5%	
Percent Allowable Offsets Used			**0%**	**100%**	
All emissions in million metric tons.					

Table B-32: Cap-and-Trade Program Energy Use: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Aviation Fuel	609	637	682	720	1.2%
Biomass	443	427	440	448	0.1%
Coal	1,185	1,212	1,063	1,043	-0.9%
Diesel	1,091	1,048	1,021	1,001	-0.6%
Ethanol	85	165	298	420	12.1%
Landfill Gas	29	29	29	29	0.2%
LPG	231	239	242	249	0.5%
Gasoline	3,303	3,219	2,920	2,628	-1.6%
Natural Gas	3,947	3,764	3,217	3,075	-1.8%
Nuclear	658	658	658	658	0.0%
Oil, Unspecified	695	687	679	688	-0.1%
Other	2,902	2,944	2,892	2,952	0.1%
Total	**15,178**	**15,031**	**14,139**	**13,911**	**-0.6%**
Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	1,638	1,769	1,813	1,856	0.9%
Commercial	1,357	1,385	1,291	1,260	-0.5%
Energy Intensive Industry	2,508	2,374	2,151	2,035	-1.5%
Other Industry	1,015	1,031	1,011	1,003	-0.1%
Agriculture	140	127	107	94	-2.8%
Passenger Transportation	3,998	4,025	3,870	3,702	-0.5%
Freight Transportation	1,219	1,183	1,204	1,235	0.1%
Waste & Wastewater	-	-	-	-	#N/A
Power Sector	3,302	3,137	2,693	2,727	-1.4%
Total	**15,178**	**15,031**	**14,139**	**13,911**	**-0.6%**

Table B-33: Cap-and-Trade Program Electric Sector Results: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Generation Capacity *(MW)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	62,973	72,139	96,879	109,919	4.1%
Coal	14,972	15,372	15,372	15,372	0.2%
Nuclear	9,330	9,330	9,330	9,330	0.0%
Hydro	61,721	63,374	63,444	63,471	0.2%
Landfill Gas/EFW	338	347	347	347	0.2%
Wind	4,083	6,827	17,979	22,945	13.1%
Other	4,358	4,537	5,618	6,354	2.7%
Total	**157,776**	**171,925**	**208,969**	**227,738**	**2.7%**
Generation Output *(GWh/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	143,907	130,007	97,216	101,382	-2.5%
Coal	99,280	100,365	86,458	85,318	-1.1%
Nuclear	65,072	65,072	65,072	65,072	0.0%
Hydro	256,243	267,713	268,207	268,398	0.3%
Landfill Gas/EFW	2,036	2,088	2,088	2,088	0.2%
Wind	8,733	16,245	47,160	60,925	14.9%
Other	23,554	24,606	30,894	34,579	2.8%
Total	**598,824**	**606,095**	**597,095**	**617,761**	**0.2%**
Sales (GWh/year)	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	202,826	218,393	223,899	232,447	1.0%
Commercial	231,140	233,974	220,827	222,998	-0.3%
Industrial	163,747	161,191	155,272	162,071	-0.1%
Transportation	4,864	6,663	7,729	8,229	3.8%
Street Lights/Misc.	16,447	16,447	16,447	16,447	0.0%
Resale	-	-	-	-	#N/A
Total Sales	**619,023**	**636,669**	**624,174**	**642,191**	**0.3%**

Table B-34: Cap-and-Trade Program Transportation Sector Results: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Distance Travelled (millions of vehicle miles travelled)					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Passenger	556,055	585,955	631,048	672,665	1.4%
Freight	72,562	73,248	77,307	81,715	0.9%
Passenger: Miles/person	8,755	8,724	8,779	8,765	0.0%
Vehicle Efficiency (miles/gallon)					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Light Gas Vehicles	23.2	24.6	28.3	32.8	2.5%
Medium Gas Vehicles	23.2	24.6	28.2	32.8	2.5%
Heavy Gas Vehicles	16.9	17.8	20.8	24.0	2.5%
Heavy Diesel Vehicles	16.9	17.8	20.8	23.9	2.5%
Vehicle efficiency represents a fleet-wide average, not the average for new vehicles.					

Table B-35: Cap-and-Trade Program Fuel Prices: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Prices (2007 $/mmBtu)	**2006**	**2010**	**2015**	**2020**
Residential				
Res Electricity Prices	29.4	30.9	29.7	30.4
Res Natural Gas Prices	11.5	13.5	14.4	16.3
Res Oil Prices	21.0	23.3	24.5	27.5
Res LPG Prices	22.7	24.2	22.0	22.8
Commercial				
Com Electricity Prices	26.4	27.8	26.5	27.2
Com Natural Gas Prices	8.8	10.0	10.0	10.9
Com Oil Prices	23.1	25.0	24.2	25.1
Com LPG Prices	22.5	24.3	22.0	22.3
Industrial				
Ind Electricity Prices	16.3	17.1	15.6	16.4
Ind Natural Gas Prices	6.7	7.4	6.6	6.7
Ind Coal Prices	2.2	2.2	2.5	3.5
Ind Oil Prices	16.4	18.4	19.6	22.0
Ind LPG Prices	23.9	25.5	23.3	23.8
Transportation				
Gasoline Prices	21.9	24.1	26.5	29.8
Diesel Prices	21.8	24.0	26.3	29.5

Table B-36: Cap-and-Trade Program Fuel Expenditures: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Annual Fuel Expenditures (M$/Yr)					
Sector	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	31,763	37,464	38,001	40,244	1.7%
Commercial	28,452	31,263	28,475	29,356	0.2%
Energy Intensive Industry	28,969	31,127	28,693	29,119	0.0%
Other Industry	14,567	16,483	16,156	17,062	1.1%
Passenger Transportation	82,031	91,324	93,969	96,251	1.1%
Freight Transportation	28,315	30,055	32,173	35,111	1.5%
Agriculture	3,140	3,140	2,625	2,499	-1.6%
Total	**217,237**	**240,856**	**240,093**	**249,641**	**1.0%**

Table B-37: Cap-and-Trade Program Potential Allowance Value: Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Allowance Value (M$)				
Sector	**2006**	**2010**	**2015**	**2020**
Residential	$0	$0	$355	$1,321
Commercial	$0	$0	$182	$631
Energy Intensive Industry	$0	$0	$1,118	$4,188
Other Industry	$0	$0	$185	$647
Passenger Transportation	$0	$0	$1,794	$6,199
Freight Transportation	$0	$0	$581	$2,164
Agriculture	$0	$0	$0	$0
Total	**$0**	**$0**	**$4,215**	**$15,150**

Potential allowance value is calculated as the allowance price times the emissions in the sector. The full allowance value may not be incurred in each sector depending on the manner in which allowances are distributed and the ability to pass allowance costs to customers.

Table B-38: Cap-and-Trade Program Annualized Costs (Savings): Eight WCI Partners Broad Scope with Complementary Policies and Offsets

Annualized Cost (M$/Yr) (Change from Reference Case)				
Sector	**2006**	**2010**	**2015**	**2020**
Residential	$0	$331	($2,279)	($6,158)
Commercial	$0	($37)	($3,632)	($7,369)
Energy Intensive Industry	$0	$1,109	$4,981	$10,908
Other Industry	$0	$258	$858	$1,996
Passenger Transportation	$0	($5,326)	($15,388)	($20,511)
Freight Transportation	$0	($0)	($119)	($522)
Agriculture	$0	($3)	($231)	($425)
Total	**$0**	**($3,668)**	**($15,810)**	**($22,080)**
These costs do not include costs of VMT Reduction programs, Energy Efficiency programs, nor Potential Allowance Value.				

Cap-and-Trade Program: Narrow Scope with Complementary Policies and Offsets

Table B-39: Cap-and-Trade Program Greenhouse Gas Emissions and Compliance Summary: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

GHG Emissions *(MMTCO2E)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	49.7	53.6	54.8	55.9	0.9%
Commercial	29.3	30.4	28.1	27.0	-0.6%
Energy Intensive Industry	176.8	174.0	171.4	172.6	-0.2%
Other Industry	29.8	30.2	28.3	26.3	-0.9%
Passenger Transport	290.8	291.7	276.8	259.9	-0.8%
Freight Transport	93.0	89.6	89.9	91.7	-0.1%
Power Sector	176.6	166.4	132.4	104.8	-3.7%
Waste & Wastewater	25.6	29.1	34.2	38.4	2.9%
Agriculture (non-energy)	59.9	62.1	64.5	71.1	1.2%
WCI Sub-Total	**931.6**	**927.1**	**880.4**	**847.8**	**-0.7%**
Compliance Summary					
Non-WCI Power Sector Reductions	-	-	(21.3)	(45.0)	
Offsets	-	-	(11.7)	(18.2)	
Bank Flow	0.0	0.0	0.0	-0.2	
Compliance Total	**1,001.6**	**997.1**	**917.4**	**854.3**	
Percent of 2006 Emissions	*100.0%*	*99.5%*	*91.6%*	*85.3%*	
Bank Inventory	0.0	0.0	2.7	0.5	
Allowance Price (2007 $/MT)	**$0**	**$0**	**$19**	**$71**	
Percentage of Offsets Allowed	5%	5%	5%	5%	
Percent of Allowable Offsets Used			**57%**	**100%**	

Table B-40: Cap-and-Trade Program Energy Use: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Aviation Fuel	609	637	683	725	1.3%
Biomass	443	427	441	452	0.1%
Coal	1,185	1,212	1,054	618	-4.5%
Diesel	1,091	1,048	1,024	1,014	-0.5%
Ethanol	85	165	298	419	12.1%
Landfill Gas	29	29	29	29	0.2%
LPG	231	239	242	250	0.5%
Gasoline	3,303	3,219	2,923	2,635	-1.6%
Natural Gas	3,947	3,764	3,210	3,296	-1.3%
Nuclear	658	658	658	658	0.0%
Oil, Unspecified	695	687	678	687	-0.1%
Other	2,902	2,944	2,889	2,934	0.1%
Total	**15,178**	**15,031**	**14,129**	**13,718**	**-0.7%**
Total Energy Use *(TBtu/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	1,638	1,769	1,815	1,863	0.9%
Commercial	1,357	1,385	1,292	1,265	-0.5%
Energy Intensive Industry	2,508	2,374	2,141	2,005	-1.6%
Other Industry	1,015	1,031	1,008	991	-0.2%
Agriculture	140	127	107	92	-2.9%
Passenger Transportation	3,998	4,025	3,873	3,712	-0.5%
Freight Transportation	1,219	1,183	1,208	1,251	0.2%
Waste & Wastewater	-	-	-	-	#N/A
Power Sector	3,302	3,137	2,685	2,539	-1.9%
Total	**15,178**	**15,031**	**14,129**	**13,718**	**-0.7%**

Table B-41: Cap-and-Trade Program Electric Sector Results: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Generation Capacity *(MW)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	62,973	72,139	96,879	109,879	4.1%
Coal	14,972	15,372	15,372	15,372	0.2%
Nuclear	9,330	9,330	9,330	9,330	0.0%
Hydro	61,721	63,374	63,444	63,462	0.2%
Landfill Gas/EFW	338	347	347	347	0.2%
Wind	4,083	6,827	17,979	22,721	13.0%
Other	4,358	4,537	5,618	6,344	2.7%
Total	**157,776**	**171,925**	**208,969**	**227,456**	**2.6%**
Generation Output *(GWh/year)*	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Gas/Oil	143,907	130,007	97,031	134,044	-0.5%
Coal	99,280	100,365	86,172	46,848	-5.2%
Nuclear	65,072	65,072	65,072	65,072	0.0%
Hydro	256,243	267,713	268,207	268,337	0.3%
Landfill Gas/EFW	2,036	2,088	2,088	2,088	0.2%
Wind	8,733	16,245	47,160	60,305	14.8%
Other	23,554	24,606	30,926	34,558	2.8%
Total	**598,824**	**606,095**	**596,656**	**611,251**	**0.1%**
Sales (GWh/year)	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	202,826	218,393	223,631	230,725	0.9%
Commercial	231,140	233,974	220,504	221,170	-0.3%
Industrial	163,747	161,191	155,498	162,118	-0.1%
Transportation	4,864	6,663	7,691	7,923	3.5%
Street Lights/Misc.	16,447	16,447	16,447	16,447	0.0%
Resale	-	-	-	-	#N/A
Total Sales	**619,023**	**636,669**	**623,771**	**638,383**	**0.2%**

Table B-42: Cap-and-Trade Program Transportation Sector Results: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Distance Travelled *(millions of vehicle miles travelled)*					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Passenger	556,055	585,955	631,324	673,720	1.4%
Freight	72,562	73,248	77,423	82,189	0.9%
Passenger: Miles/person	8,755	8,724	8,782	8,778	0.0%
Vehicle Efficiency *(miles/gallon)*					
	2006	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Light Gas Vehicles	23.2	24.6	28.2	32.8	2.5%
Medium Gas Vehicles	23.2	24.6	28.2	32.8	2.5%
Heavy Gas Vehicles	16.9	17.8	20.8	24.0	2.5%
Heavy Diesel Vehicles	16.9	17.8	20.8	23.9	2.5%
Vehicle efficiency represents a fleet-wide average, not the average for new vehicles.					

Table B-43: Cap-and-Trade Program Fuel Prices: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Prices (2007 $/mmBtu)	**2006**	**2010**	**2015**	**2020**
Residential				
Res Electricity Prices	29.4	30.9	30.4	33.9
Res Natural Gas Prices	11.5	13.5	14.0	14.6
Res Oil Prices	21.0	23.3	24.0	25.5
Res LPG Prices	22.7	24.2	21.7	21.6
Commercial				
Com Electricity Prices	26.4	27.8	27.2	31.2
Com Natural Gas Prices	8.8	10.0	9.8	10.0
Com Oil Prices	23.1	25.0	24.0	24.7
Com LPG Prices	22.5	24.3	21.8	21.7
Industrial				
Ind Electricity Prices	16.3	17.1	16.3	20.8
Ind Natural Gas Prices	6.7	7.4	6.8	7.5
Ind Coal Prices	2.2	2.2	3.3	6.0
Ind Oil Prices	16.4	18.4	20.3	24.7
Ind LPG Prices	23.9	25.5	23.6	24.7
Transportation				
Gasoline Prices	21.9	24.1	26.0	28.0
Diesel Prices	21.8	24.0	25.8	27.7

Table B-44: Cap-and-Trade Program Fuel Expenditures: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Annual Fuel Expenditures (M$/Yr)					
Sector	**2006**	**2010**	**2015**	**2020**	**Growth Rate 2006-2020**
Residential	31,763	37,464	38,520	43,138	2.2%
Commercial	28,452	31,263	28,989	32,098	0.9%
Energy Intensive Industry	28,969	31,127	28,806	29,831	0.2%
Other Industry	14,567	16,483	16,327	17,977	1.5%
Passenger Transportation	82,031	91,324	94,072	96,577	1.2%
Freight Transportation	28,315	30,055	32,280	35,568	1.6%
Agriculture	3,140	3,140	2,661	2,669	-1.2%
Total	217,237	240,856	241,656	257,859	1.2%

Table B-45: Cap-and-Trade Program Potential Allowance Value: Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Allowance Value (M$)				
Sector	**2006**	**2010**	**2015**	**2020**
Residential	$0	$0	$0	$0
Commercial	$0	$0	$521	$1,925
Energy Intensive Industry	$0	$0	$3,176	$12,293
Other Industry	$0	$0	$524	$1,873
Passenger Transportation	$0	$0	$0	$0
Freight Transportation	$0	$0	$0	$0
Agriculture	$0	$0	$0	$0
Total	**$0**	**$0**	**$4,221**	**16,092**
Potential allowance value is calculated as the allowance price times the emissions in the sector. The full allowance value may not be incurred in each sector depending on the manner in which allowances are distributed and the ability to pass allowance costs to customers.				

Table B-46: Cap-and-Trade Program Annualized Costs (Savings): Eight WCI Partners Narrow Scope with Complementary Policies and Offsets

Annualized Cost (M$/Yr) (Change from Reference Case)				
Sector	**2006**	**2010**	**2015**	**2020**
Residential	$0	$331	($1,771)	($3,327)
Commercial	$0	($37)	($3,144)	($4,760)
Energy Intensive Industry	$0	$1,109	$5,237	$12,674
Other Industry	$0	$258	$1,085	$3,250
Passenger Transportation	$0	($5,326)	($15,073)	($19,005)
Freight Transportation	$0	($0)	$0	$0
Agriculture	$0	($3)	($194)	($254)
Total	**$0**	**($3,668)**	**($13,859)**	**($11,422)**
These costs do not include costs of VMT Reduction programs, Energy Efficiency programs, nor Potential Allowance Value.				

Appendix C: General Q & A

Western Climate Initiative

Q: What is the Western Climate Initiative announcing today?

The Western Climate Initiative (WCI) Partners today announced their proposed design of a regional market-based cap-and-trade program. This program is an important component of a comprehensive regional effort to reduce the pollution that causes global warming to 15 percent below 2005 levels by 2020.

Q: What are the market design elements being released by the WCI?

The WCI partners are recommending a multi-sector cap-and-trade program to reduce the pollution that causes global warming to 15% below 2005 levels by 2020. This program includes the following design parameters:

- A limit on the emissions from all major sources of global warming pollutants;
- Include under the cap all electricity-related emissions, including those associated with electricity imported from outside the WCI partner jurisdictions;
- Ensure that all regulated entities use a consistent reporting methodology; and
- Mitigate economic impacts on consumers and regulated entities by allowing flexibility in how and when the reductions are made (e.g., banking of allowances and the limited use of offsets).

Q: How was the WCI market design developed?

The release of the WCI design recommendations is the culmination of 18 months of extensive analysis, stakeholder consultation and deliberation by the WCI Partners. We will continue to consult with and seek input from the broad range of stakeholders who contributed to this process.

Q: What are the next steps?

The release of this market design program marks the culmination of 18 months of extensive analysis, stakeholder consultation and deliberation by the WCI Partners. This proposal will now be further developed by each WCI Partner with the objective of taking the steps necessary to implement the program.

The timeline agreed to by the WCI Partners is that each will begin reporting emissions in 2011 for emissions that occur in 2010. The first phase of the cap-and-trade program will begin on January 1, 2012, with a three-year compliance period. The second phase will begin in 2015, when the program is expanded to include transportation fuels and residential, commercial and industrial fuels.

Q: What emissions sources are subject to the cap under the WCI agreement?

The WCI cap-and-trade program covers the largest emitters from each state and province, including energy (electricity generation, natural gas and heating fuels), industrial emissions and transportation emissions.

Q: How will emissions allowances be distributed under the WCI agreement?

Each WCI Partner jurisdiction will have an emission allowance budget under the cap-and-trade program that is consistent with its jurisdiction-specific emissions goal for 2020. Each Partner has the flexibility to decide how best to allocate its allowance budget within its jurisdiction.

For instance, a Partner could "give" allowances to the emitters operating within its jurisdiction, "auction" the allowances to willing buyers, or provide for some combination of the two. The WCI design calls for a minimum auction level of 10% at the start of the program, increasing to at least 25% by 2020. Each jurisdiction may auction a higher percentage if it so chooses. In addition, the WCI Partners have agreed to use a portion of the allowance value for purposes with region-wide benefits, such as energy efficiency and low-carbon technology development.

Q: How will compliance be determined under the WCI agreement?

The bedrock of a cap-and-trade system is a rigorous emissions reporting requirement. The regulated sources are required to ensure the data are accurate and complete. Each WCI partner will require third party validation of reported emissions from entities and facilities that will be included under the cap.

The WCI agreement is consistent with previous well-designed cap-and-trade programs that have had compliance rates of over 99 percent. At the end of each compliance period, facilities and entities with emissions are required to submit the same number of emission allowances to the government as the emissions they had during that compliance period. If the facility or entity does not have sufficient emission allowances to cover its emissions, a "penalty" of three allowances will be assessed for each one they are short.

Q: What are offsets? How are they handled under the WCI agreement?

Offsets are reductions in greenhouse gas emissions from outside of the capped sectors, such as forestry and agriculture. Offset credits may be used, provided they meet rigorous criteria to ensure that emission reductions are real, verifiable, surplus/additional, permanent and enforceable. Offset credits may be traded. The WCI program limits the use of offsets for compliance purposes to ensure that a majority of the required emission reductions is achieved in the sources covered by the cap-and-trade program.

Appendix E: List of Measures

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List of Measures

The following tables include only the Recommended Actions contained in the Scoping Plan. It is provided as a reference. For complete details of the measures, please see the applicable sector in Appendix C.

Appendix E—List of Recommended Actions by Tons
Table 1

Measure No.	Measure Description	GHG Reductions (MMTCO2E)
T-1	Pavley I and II – Light-Duty Vehicle Greenhouse Gas Standards	31.7
GB-1	Green Buildings	26†
E-3	Renewables Portfolio Standard (33% by 2020)	21.3
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards Additional Efficiency and Conservation Programs	15.2
T-2	Low Carbon Fuel Standard (Discrete Early Action)	15
H-6	High GWP Reductions from Stationary Sources • High GWP Stationary Equipment Refrigerant Management Program: o Refrigerant Tracking/Reporting/ Repair Deposit Program o Specifications for Commercial and Industrial Refrigeration Systems • Foam Recovery and Destruction Program • SF_6 Leak Reduction and Recycling in Electrical Applications • Alternative Suppressants in Fire Protection Systems • Residential Refrigeration Early Retirement Program	10.9

List of Measures

Measure No.	Measure Description	GHG Reductions (MMTCO2E)
RW-3	High Recycling/Zero Waste • Commercial Recycling • Increase Production and Markets for Compost • Anaerobic Digestion • Extended Producer Responsibility • Environmentally Preferable Purchasing	9†
E-2	Increase Combined Heat and Power Use by 30,000 GWh (Net reductions include avoided transmission line loss)	6.7
H-7	Mitigation Fee on High GWP Gases	5
F-1	Sustainable Forest Target	5
T-3[1]	Regional Transportation-Related Greenhouse Gas Targets	5
T-4	Vehicle Efficiency Measures	4.5
CR-1	Energy Efficiency (800 Million Therms Reduced Consumption) • Utility Energy Efficiency Programs • Building and Appliance Standards • Additional Efficiency and Conservation Programs	4.3
T-6	Goods Movement Efficiency Measures • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.5
H-5	High GWP Reductions from Mobile Sources • Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems • Air Conditioner Refrigerant Leak Test During Vehicle Smog Check • Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers • Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	3.3

[1] This is not the SB 375 regional target. ARB will establish regional targets for each MPO region following the input of the regional targets advisory committee and a consultation process with MPO's and other stakeholders per SB 375.

List of Measures

Measure No.	Measure Description	GHG Reductions (MMTCO2E)
E-4	Million Solar Roofs (including California Solar Initiative, New Solar Homes Partnership and solar programs of publicly owned utilities) • Target of 3000 MW Total Installation by 2020	2.1
W-3	Water System Energy Efficiency	2.0†
W-1	Water Use Efficiency	1.4†
RW-1	Landfill Methane Control (Discrete Early Action)	1
T-9	High Speed Rail	1
A-1	Methane Capture at Large Dairies	1.0†
T-7	Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measure - Aerodynamic Efficiency (Discrete Early Action)	0.93
I-3	GHG Leak Reduction from Oil and Gas Transmission	0.9
W-5	Increase Renewable Energy Production	0.9†
T-8	Medium- and Heavy-Duty Vehicle Hybridization	0.5
I-4	Refinery Flare Recovery Process Improvements	0.33
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3
W-2	Water Recycling	0.3†
H-1	Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)	0.26
H-4	Limit High GWP Use in Consumer Products Discrete Early Action (Adopted June 2008)	0.25
I-2	Oil and Gas Extraction GHG Emission Reduction	0.2
W-4	Reuse Urban Runoff	0.2†
T-4	Ship Electrification at Ports (Discrete Early Action)	0.2
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)	0.15
CR-2	Solar Water Heating (AB 1470 goal)	0.1
I-5	Removal of Methane Exemption from Existing Refinery Regulations	0.01

List of Measures

Measure No.	Measure Description	GHG Reductions (MMTCO2E)
RW-2	Additional Reductions in Landfill Methane • Increase the Efficiency of Landfill Methane Capture	TBD†
W-6	Public Goods Charge (Water)	TBD†
I-1	Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	TBD

†GHG emission reduction estimates are not included in calculating the total reductions needed to meet the 2020 target

Appendix E—List of Recommended Actions by Sector

Table 2

`	Measure Description	GHG Reductions (MMTCO2E)
Transportation		
T-1	Pavley I and II – Light-Duty Vehicle Greenhouse Gas Standards	31.7
T-2	Low Carbon Fuel Standard (Discrete Early Action)	15
T-3[1]	Regional Transportation-Related Greenhouse Gas Targets	5
T-4	Vehicle Efficiency Measures	4.5
T-5	Ship Electrification at Ports (Discrete Early Action)	0.2
T-6	Goods Movement Efficiency Measures • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.5
T-7	Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measure - Aerodynamic Efficiency (Discrete Early Action)	0.93
T-8	Medium- and Heavy-Duty Vehicle Hybridization	0.5
T-9	High Speed Rail	1
Electricity and Natural Gas		
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards Additional Efficiency and Conservation Programs	15.2
E-2	Increase Combined Heat and Power Use by 30,000 GWh (Net reductions include avoided transmission line loss)	6.7
E-3	Renewables Portfolio Standard (33% by 2020)	21.3

E-4	Million Solar Roofs (including California Solar Initiative, New Solar Homes Partnership and solar programs of publicly owned utilities) • Target of 3000 MW Total Installation by 2020	2.1
CR-1	Energy Efficiency (800 Million Therms Reduced Consumption) • Utility Energy Efficiency Programs • Building and Appliance Standards • Additional Efficiency and Conservation Programs	4.3
CR-2	Solar Water Heating (AB 1470 goal)	0.1
Green Buildings		
GB-1	Green Buildings	26†
Water		
W-1	Water Use Efficiency	1.4†
W-2	Water Recycling	0.3†
W-3	Water System Energy Efficiency	2.0†
W-4	Reuse Urban Runoff	0.2†
W-5	Increase Renewable Energy Production	0.9†
W-6	Public Goods Charge (Water)	TBD†
Industry		
I-1	Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	TBD
I-2	Oil and Gas Extraction GHG Emission Reduction	0.2
I-3	GHG Leak Reduction from Oil and Gas Transmission	0.9
I-4	Refinery Flare Recovery Process Improvements	0.3
I-5	Removal of Methane Exemption from Existing Refinery Regulations	0.01
Recycling and Waste Management		
RW-1	Landfill Methane Control (Discrete Early Action)	1
RW-2	Additional Reductions in Landfill Methane • Increase the Efficiency of Landfill Methane Capture	TBD†

RW-3	High Recycling/Zero Waste • Commercial Recycling • Increase Production and Markets for Compost • Anaerobic Digestion • Extended Producer Responsibility • Environmentally Preferable Purchasing	9†
Forests		
F-1	Sustainable Forest Target	5

High Global Warming Potential (GWP) Gases		
H-1	Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)	0.26
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)	0.15
H-4	Limit High GWP Use in Consumer Products Discrete Early Action (Adopted June 2008)	0.25
H-5	High GWP Reductions from Mobile Sources • Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems • Air Conditioner Refrigerant Leak Test During Vehicle Smog Check • Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers • Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	3.3

H-6	High GWP Reductions from Stationary Sources
	• High GWP Stationary Equipment Refrigerant Management Program:
	  o Refrigerant Tracking/Reporting/Repair Deposit Program
	  o Specifications for Commercial and Industrial Refrigeration Systems
	• Foam Recovery and Destruction Program
	• SF_6 Leak Reduction and Recycling in Electrical Applications
	• Alternative Suppressants in Fire Protection Systems
	• Residential Refrigeration Early Retirement Program
		10.9

H-7	Mitigation Fee on High GWP Gases	5
Agriculture		
A-1	Methane Capture at Large Dairies	1.0†

†GHG emission reduction estimates are not included in calculating the total reductions needed to meet the 2020 target

Appendix F: California's Greenhouse Gas Emissions Inventory

The inventories presented here are summaries of 1990, 2004, and 2020 projected BAU as discussed in the Scoping Plan. For detailed 1990 and 2004 inventories please see:
http://www.arb.ca.gov/cc/inventory/inventory.htm
More detailed information about the 2020 inventory will be released in July at the above web address. Comments on this forecast can be submitted at:
http://www.arb.ca.gov/cc/scopingplan/spcomment.htm

Greenhouse Gas Emission Inventory and Forecasting

ARB is responsible for developing the California Greenhouse Gas Emission Inventory. The Inventory accounts for all greenhouse gas (GHG) emissions within the state of California and supports the AB 32 Climate Change Program. The Inventory also serves as the basis for developing future year GHG emission forecasts necessary to support measure development and Scoping Plan recommendations. ARB staff has developed a year 2020 "business-as-usual" (BAU) forecast of GHG emissions for use in developing the Scoping Plan.

Greenhouse Gas Emission Inventory

ARB's current GHG emission inventory is based on statewide fuel use, process, and activity data to estimate emissions. These estimates use the actual amount of all fuels combusted in the state, which accounts for over 85 percent of the greenhouse gas emissions within California.

This approach to inventory development is referred to as "top-down" because data are collected in the aggregate for the entire state, not at the level of the individual facility or emission-point. In contrast, a "bottom-up" inventory uses data from individual sources to determine emissions and sums those emissions to form a statewide total. Once ARB's mandatory reporting regulation is implemented, facility-specific data will become available and will be used to further improve the inventory. Current GHG emissions data can be found on ARB's website at: http://www.arb.ca.gov/cc/inventory/inventory.htm

Business-as-Usual 2020 Emissions

ARB staff estimated 2020 business-as-usual GHG emissions, which represent the emissions that would be expected to occur in the absence of any GHG reductions actions. ARB staff estimates the statewide 2020 business-as-usual greenhouse gas emissions will be 596 $MMTCO_2E$. Emission reductions from the recommended measures in the Scoping Plan total 169 $MMTCO_2E$, allowing California to attain the 2020 emissions limit of 427 $MMTCO_2E$.

The 2020 BAU emissions estimate was derived by projecting emissions from a past baseline year using growth factors specific to each of the different economic sectors. For the purposes of the Scoping Plan, ARB used three-year average emissions, by sector, for 2002-2004 to forecast emissions to 2020. At the time the Scoping Plan process was initiated, 2004 was the most recent year for which actual data were available.

This 3-year average of known emissions will dampen unusual variations in any given year that would make the baseline year unrepresentative for forecasting. For example, an unusually hot, dry year might cause much higher power consumption and less hydroelectric power generation, and therefore increased emissions associated with power generation than would have otherwise been expected.

Forecasting Method

Growth factors are sector-specific and are derived from several sources, including the energy demand models generated by California Energy Commission (CEC) for their 2007 Integrated Energy Policy Report (IEPR), business economic growth data developed for ARB's criteria pollutant forecast system (CEFS), population growth data from the California Department of Finance, and projections of vehicle miles traveled from ARB's on-road mobile source emissions

model, EMFAC2007. For the electricity and other energy sectors, ARB consulted with CEC to select the most appropriate growth factor.

ARB's forecasting method is similar to other GHG forecasting approaches, including the method used in the Climate Action Team 2006 Report. Where appropriate, ARB used updated and improved growth factors for estimating 2020 emissions sector-by-sector. These future emissions are projected in the absence of any policies or actions that would reduce emissions. The resulting BAU estimates are compared to the 2020 target set by the Board in December 2007 to determine the total statewide GHG reductions needed.

Sector Forecasts

Descriptions of the 2020 BAU forecasts for the major sectors of the inventory are given below with key assumptions staff used to estimate these future emissions.

Electricity

The 2020 business-as-usual emissions forecast for the electric power sector is 139.2 $MMTCO_2E$. These emissions are the result of in-state power generation plus specified and unspecified imported power. BAU forecasted emissions assume that all growth in electricity demand by 2020 will be met by in-state natural gas-fired power plants. Expected growth in renewable power to meet the current and proposed Renewables Portfolio Standard (RPS) is not included in the BAU. This allows the Scoping Plan reductions from increasing renewable power generation to be additive with the BAU forecasted 2020 emissions.

The 2020 BAU forecast for emissions from specified sources of imported electricity (i.e., power received from specific out-of-state power plants) is assumed to decrease resulting from the closure of one coal-fired power plant (i.e., Mojave) previously supplying imported electricity. The demand previously served by the closed plant is now replaced by in-state natural-gas generation.

Based on outputs from the CEC's electricity demand models, in-state electricity generation and specified imports will not meet the State's full electricity demand in 2020. The remaining demand is assumed to be met by unspecified imported electricity (i.e., power received from a mix of power generating sources outside the State).

Transportation

GHG emissions in 2020 from the transportation sector as a whole are expected to increase from current levels to 225.4 $MMTCO_2E$. This forecasted increase is dominated by increases in emissions from on-road transportation, i.e., passenger cars and heavy-duty trucks. To forecast on-road transportation emissions, ARB staff used 2007 fuel sales data obtained from the California Board of Equalization and estimated 2020 emissions based on the growth in projected vehicle miles traveled (VMT) derived from EMFAC2007. This BAU forecast assumes no change in vehicle fleet mix over time.

Industrial

The industrial sector consists of large stationary sources of GHG emissions and includes oil and gas production and refining, cement plants, and large manufacturing facilities. Emissions for this

sector are forecasted to grow to 100.5 $MMTCO_2E$ by 2020, an increase of approximately five percent from the average emissions level of 2002-2004.

Business-as-usual forecasted emissions for this sector are variable, but overall are not expected to grow substantially. Most of the growth from this sector comes from the fuel use and process emissions of two industries: Cement Plants and Refineries.

Emissions from the combustion of natural gas are expected to grow for some industries (e.g., cement plants) and decline for others (e.g., food processors). These assumptions of growth and decline in natural gas demand are based on outputs from energy demand modeling conducted by CEC staff for the 2007 IEPR.

Landfills

Forecasted BAU emissions in 2020 for landfills are 7.7 $MMTCO_2E$. This forecast uses a recognized landfill gas emissions model developed by the Intergovernmental Panel on Climate Change (IPCC) and data from the California Integrated Waste Management Board (CIWMB).

The forecast reflects assumptions regarding the continued decay of existing waste in landfills and estimates on the amount and character of new waste deposited in landfills through 2020.

Commercial & Residential

The Commercial and Residential sector is expected to contribute 46.7 $MMTCO_2E$ or about eight percent of the total statewide GHG emissions in 2020. Forecasted BAU emissions from the Commercial sector include combustion emissions from natural gas and other fuels (i.e., diesel) used by office buildings and small businesses. Residential emissions result primarily from natural gas combustion used for space heating and for hot water heaters.

Growth in emissions from the Commercial and Residential sector is due primarily to the expected increase in population and assumed increase use of natural gas. Emissions from the use of other fuels, such as diesel fuel, are assumed to remain relatively constant over time.

High Global Warming Potential Gases

The forecasted BAU 2020 emissions of High Global Warming Potential (High-GWP) gases are 46.9 $MMTCO_2E$. High-GWP gases, including sulfur hexafluoride (SF6) from electric utility applications, substitutes for ozone depleting substances (ODS) (primarily HFCs and PFCs), and other High-GWP gases used in semiconductor manufacturing and other industrial processes are combined under one sector for purposes of the Scoping Plan. Assumptions used to forecast business-as-usual emissions of High-GWP gases vary by GHG.

SF6 emissions occur primarily from leaks in electrical transmission system equipment in which SF6 is used as an electrical insulator. SF6 leaks are constant from a given piece of electrical equipment and are not related to the use of the equipment. The probable expansion of the electrical transmission system infrastructure is assumed to result in more SF6 emissions from leaks. However, at the same time, technical improvements to the transmission system equipment result in fewer leaks, reducing SF6 emissions. ARB assumes that the effect of an expansion of the electrical transmission system infrastructure, combined with the technical improvements to the equipment in the system, will result in no net change in emissions in 2020.

Emissions of HFCs and PFCs as ODS substitutes occur from their use in refrigeration and air conditioning systems, among other commercial and industrial applications. The high business-as-usual forecasted emissions in 2020 comes about as ODSs are rapidly replaced by ODS substitutes, as more ODSs are phased out.

Agriculture

BAU emissions from the agriculture sector are forecasted to increase about seven percent from current levels to 29.8 $MMTCO_2E$ in 2020, due exclusively to the assumed increase in livestock population. The agriculture sector includes emissions from livestock, i.e., digestive processes and manure management; combustion of liquid and gaseous fuels used for irrigation and crop production; emissions from fertilizer use and application of other soil additives; and emissions from agricultural residue burning.

Agricultural residue burning and livestock emissions were forecasted using ARB's criteria pollutant forecasting approach. Forecasted emissions from the combustion of natural gas were estimated using outputs from the 2007 IEPR developed by CEC. Other agriculture-rated emissions were either held constant or extrapolated using historical trends to obtain a 2020 BAU estimate.

Forestry

The forest sector is unique in the inventory because it combines GHG emissions to the atmosphere from wildfires, land conversion, wood combustion, wood decomposition, and other emission sources with removal of CO2 from the atmosphere due to forest growth. Positive emissions and negative removals are combined into a single net value. Therefore, a negative value indicates that the forest sector is sequestering carbon or a sink i.e. more CO2 is removed from the atmosphere than is emitted.

Appendix F Table 3

California GHG Inventory by Category as Defined in the Scoping Plan
(millions of metric tons of CO_2 equivalent)

Inventory Summary for Scoping Plan (June 26, 2008)	Emissions (MMTCO2E) 2002-2004 Average	2020 Forecast
Transportation	**179.3**	**225.4**
On Road	***168.7***	***209.1***
Passenger Vehicles	133.9	160.8
Heavy Duty Trucks	34.7	48.3
Ships & Commercial Boats	***3.3***	***6.3***
Aviation (Intrastate)	***3.2***	***4.8***
Rail	***3.0***	***3.8***
Unspecified	***1.2***	***1.4***
Electric Power	**109.0**	**139.2**
In-State Generation	***52.5***	***87.2***
Natural Gas	44.2	78.8
Other Fuels	8.4	8.4
Imported Electricity	***56.5***	***52.0***
Unspecified Imports	24.3	26.1
Specified Imports	32.2	25.9
Commercial and Residential	**41.0**	**46.7**
Residential Fuel Use	***28.5***	***32.1***
Natural Gas	26.9	30.6
Other Fuels	1.6	1.5
Commercial Fuel Use	***11.9***	***14.0***
Natural Gas	10.5	12.3
Other Fuels	1.4	1.6
Commercial Cogeneration Heat Output	***0.6***	***0.7***
Industrial	**95.9**	**100.5**
Refineries	***35.0***	***36.7***
General Fuel Use	***21.3***	***19.8***
Natural Gas	14.0	11.7
Other Fuels	7.3	8.1
Oil & Gas Extraction	***14.2***	***14.2***
Fuel Use	13.4	13.4
Fugitive Emissions	0.8	0.7
Cement Plants	***9.7***	***12.6***
Clinker Production	5.7	7.6
Fuel Use	4.1	5.0
Cogeneration Heat Output	***9.2***	***9.3***
Other Process Emissions	***6.4***	***7.9***

Inventory Summary for Scoping Plan (June 26, 2008)	Emissions (MMTCO2E) 2002-2004 Average	2020 Forecast
Recycling and Waste	**5.6**	**7.7**
Landfills[1]	***5.6***	***7.7***
High GWP	**14.7**	**46.9**
Ozone Depleting Substance Substitutes	***12.9***	***45.0***
Electricity Grid SF6 Losses[2]	***1.0***	***1.0***
Semiconductor Manufacturing[1]	***0.8***	***0.8***
Agriculture	**27.7**	**29.8**
Livestock	***13.9***	***16.2***
Enteric Fermentation (Digestive Process)	7.0	8.2
Manure Management	6.9	8.0
Crop Growing & Harvesting	***9.2***	***9.2***
Fertilizers	7.1	7.1
Soil Preparation and Disturbances	2.0	2.0
Crop Residue Burning	0.1	0.1
General Fuel Use	***4.6***	***4.5***
Diesel	3.3	3.3
Natural Gas	0.7	0.5
Gasoline	0.4	0.4
Other Fuels	0.2	0.2
Forestry	**0.2**	**0.2**
Wildfire (CH4 & N_2O Emissions)	***0.2***	***0.2***
TOTAL GROSS EMISSIONS	**473.5**	**596.4**
Forestry Net Emissions	***(-4.7)***	***0.0***
TOTAL NET EMISSIONS	**468.8**	**596.4**

[1] These categories are under the Industrial Sector in ARB's GHG Emission Inventory

[2] This category is under the Electric Power Sector in ARB's GHG Emission Inventory

Appendix F Table 4

California GHG Inventory by Sector (millions of tonnes of CO2 equivalent)

(CO2 equivalence based upon IPCC Second Assessment Report's Global Warming Potentials)

Categories Included in the Inventory.	***1990***	***02-04***	***2020***
Agriculture & Forestry	**23.62**	**27.91**	**30.01**
Ag Energy Use	*4.50*	*4.63*	*4.47*
Ag Residue Burning	*0.12*	*0.08*	*0.08*
Ag Soil Management	*6.54*	*8.40*	*8.40*
Enteric Fermentation	*6.67*	*7.03*	*8.17*
Forest and Range Management	*0.19*	*0.19*	*0.19*
Histosol Cultivation	*0.18*	*0.14*	*0.14*
Manure Management	*5.00*	*6.88*	*7.99*
Rice Cultivation	*0.41*	*0.56*	*0.56*
Commercial	**14.43**	**12.45**	**14.63**
CHP: Commercial (UTO)	*0.40*	*0.56*	*0.66*
Communication	*0.07*	*0.09*	*0.11*
Domestic Utilities	*0.34*	*0.50*	*0.58*
Education	*1.42*	*1.04*	*1.22*
Food Services	*1.89*	*2.44*	*2.87*
Health Care	*1.32*	*1.23*	*1.44*
Hotels	*0.67*	*0.64*	*0.76*
National Security	*0.56*	*0.18*	*0.21*
Not Specified	*5.58*	*3.26*	*3.83*
Offices	*1.46*	*1.85*	*2.17*
Retail & Wholesale	*0.68*	*0.60*	*0.70*
Transportation Services	*0.03*	*0.05*	*0.06*
Electricity Generation (Imports)	**61.58**	**56.82**	**52.36**
Specified Imports	*29.61*	*32.17*	*25.89*
Unspecified Imports	*30.96*	*24.30*	*26.13*
Transmission and Distribution (SF_6)	*1.02*	*0.34*	*0.34*
Electricity Generation (In State)	**49.05**	**53.22**	**87.88**
CHP: Commercial	*0.70*	*0.80*	*1.46*
CHP: Industrial	*14.54*	*20.27*	*31.38*
Merchant Owned	*2.33*	*26.01*	*44.60*
Utility Owned	*29.92*	*5.45*	*9.75*
Transmission and Distribution (SF_6)	*1.56*	*0.69*	*0.69*
Industrial	**103.03**	**99.02**	**105.84**
CHP: Industrial (UTO)	*9.70*	*9.20*	*9.27*
Flaring	*0.15*	*0.11*	*0.11*
Landfills	*6.26*	*5.64*	*7.66*
Manufacturing	*31.98*	*27.27*	*28.93*
Mining	*0.03*	*0.25*	*0.19*
Not Specified	*2.63*	*2.10*	*2.27*
Oil & Gas Extraction	*14.65*	*14.19*	*14.19*
Petroleum Marketing	*0.02*	*0.00*	*0.00*
Petroleum Refining	*32.82*	*35.03*	*36.72*
Pipelines	*1.63*	*1.45*	*1.79*
Waste Water Treatment	*3.17*	*3.78*	*4.72*
Residential	**29.66**	**28.52**	**32.10**
Household Use	*29.66*	*28.52*	*32.10*
Transportation	**150.67**	**179.31**	**225.40**
Aviation (intrastate)	*5.13*	*3.18*	*4.84*
Not Specified	*3.01*	*1.21*	*1.35*
On Road	*137.99*	*168.66*	*209.10*
Rail	*2.33*	*3.00*	*3.76*
Water-borne (within 24 nautical miles from California coast)	*2.21*	*3.26*	*6.35*

Not Specified (across all sectors)	**1.27**	**16.21**	**48.19**
Unspecified fuel combustion	*1.23*	*3.34*	*3.20*
Use of substitutes for ozone depleting substances	*0.04*	*12.87*	*44.99*

Summary of Categories Included in the Inventory.	**1990**	**02-04**	**2020**
Gross California Emissions	**433.29**	**473.45**	**596.41**
Sinks from Forests and Rangelands	**-6.69**	**-4.67**	**0.00**
Net California Emissions	**426.60**	**468.78**	**596.41**

Categories Excluded from the Inventory.	***1990***	***02-04***	***2020***
Transportation	**59.02**	**46.01**	**84.30**
Aviation (interstate and international)	*33.95*	*34.06*	*53.02*
Water-borne (interstate and international)	*25.06*	*11.94*	*31.28*

Summary of Categories Excluded from the Inventory.	**1990**	**02-04**	**2020**
Total Excluded Emissions	**59.02**	**46.01**	**84.30**

Climate Change Scoping Plan Appendices

VOLUME II:
ANALYSIS AND DOCUMENTATION

a framework for change

DECEMBER 2008

Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

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Appendix G-II: Environmental Dynamic Revenue Assessment Model's Sources and Methods

Appendix G-III: Economic Analysis of California Climate Policy Initiatives using the Berkeley Energy and Resources (BEAR) Model

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* This appendix is not included because the BEAR model was not run for the Recommendation in the Scoping Plan. For results from the BEAR model, see the Economic Analysis Supplement to the Draft Scoping Plan

Climate Change Scoping Plan Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Appendix G
Economic Analysis

EXECUTIVE SUMMARY

The California Air Resources Board (ARB) is the lead agency charged with implementation of AB 32, the Global Warming Solutions Act of 2006, which requires a statewide reduction of greenhouse gas emissions to 1990 levels by 2020. As the lead agency, ARB is required to develop and approve a Scoping Plan by January 1, 2009, that proposes a comprehensive set of actions designed to achieve the reductions.

The Scoping Plan (Plan) sets out ARB's Recommendation for reducing California's greenhouse gas emissions. Key elements of the Recommendation include the expansion and strengthening of energy efficiency programs, achieving a statewide renewable energy mix of 33 percent, development of a California cap-and-trade program that links with other Western Climate Initiative partner programs, and the implementation of both new and existing state laws and policies geared toward reducing greenhouse gas emissions from the transportation sector.

As required by AB 32, we conducted an economic analysis of the Plan. This analysis is a thorough assessment of the economic impact of the recommended greenhouse gas emission reduction measures on California consistent with the plan's broad programmatic framework of measures and approaches. It shows that implementing the recommended measures will have an overall positive impact on economic growth in California. We will analyze individual strategies and measures in more detail as they are further developed during the measure development and adoption process.

Choosing a Cleaner Path

The Plan outlines an approach that will position California for a more secure, sustainable future where we invest heavily in energy efficiency and clean technologies. This economic analysis indicates that implementation of this forward-looking approach creates more jobs and saves individual households more money than if we stood by and pursued an unacceptable course of doing nothing at all to address our unbridled reliance on fossil fuels.

Continued economic growth is perhaps the clearest indicator of the fundamental health of California's economy. Under a business-as-usual case (i.e., without putting into effect any of the recommended measures to reduce global warming emissions), economic growth is expected to total 43 percent between now and 2020, culminating in a Gross State Product of almost $2.6 trillion. The analysis we have conducted indicates that if California implements the comprehensive greenhouse gas reduction strategy recommended in the Plan not only will the economy grow by a similar amount as we move toward 2020, but it will grow at a

slightly higher rate. Increased economic growth is anticipated primarily because the investments motivated by several measures, such as the expansion and strengthening of existing energy efficiency programs and implementation of new and existing policies to reduce emissions from the transportation sector, result in substantial energy savings that more than pay back the cost of the investments at expected future energy prices. These results support the conclusion that the decision California made in 2006 to reduce its greenhouse gas emissions was not just a good environmental choice, it also will help sustain growth and enable the state to reap the full range of economic benefits that come with a transition to a more sustainable future.

Overall Impact on the Economy

Our analysis relied upon the Environmental Dynamic Revenue Assessment Model (E-DRAM), a macroeconomic model that characterizes the flow of production, consumption, investment, and saving throughout the California economy in response to specified policies. ARB has previously used E-DRAM to assess the economic impacts of its regulations.

Macroeconomic models such as E-DRAM are best suited to analyzing the economy-wide impact of a set of recommended policy measures by taking into account their interaction and the shifting of economic activity across sectors. Such tools and related cost-estimation methods, however, tend to understate the benefits afforded by market-based policies because they cannot accurately model some important cost-saving features of market-based compliance mechanisms, such as those included in California's clean car standards (AB 1493, Chapter 200, Statutes of 2002, Pavley), those anticipated as part of the low carbon fuel standard, and in particular, a cap-and-trade program. This is largely the result of the inability of macroeconomic models to predict how firms might invest in cost-effective energy efficient technologies at individual facilities that will result in reduced greenhouse gas emissions and reduced energy-related expenditures. As a result of this limitation, our economic analysis likely understates the extent of the positive impact on the California economy from the full complement of measures in the Recommendation.

With these caveats in mind, our modeling shows that implementation of the Recommendation in the Plan will benefit California's economy above and beyond the business-as-usual projections, in 2020, by:

- Increasing production activity by $33 billion
- Increasing overall Gross State Product by $7 billion
- Increasing overall personal income by $16 billion
- Increasing per capita income by $200
- Increasing jobs by more than 100,000

Sector Specific Impacts

In addition to assessing the overall economic impacts of the Plan, we also evaluated the impacts that implementing the Recommendation would have on households, employment, businesses including small business, jobs, and green technology. Overall economic impacts for each of these sectors are consistent with the other findings and are projected to be small,

and for the most part positive, keeping in mind that the models tend to underestimate the benefits to the economy as a result of market mechanisms.

Business Sectors

Compared to the business-as-usual case the implementation of the Recommendations minimally alters current growth projections for most business sectors, and in fact enhances their growth in most cases. A potential decrease in output and employment is, however, projected for the utility and to a lesser extent for the retail sectors. The primary reason for these projections is that consumers are expected to purchase a decreasing amount of electric power, natural gas, and gasoline – considered by the model to be a retail 'product' – as a result of the implementation of efficiency measures contained in the Plan. While increased spending on efficiency and renewable energy is expected to increase employment overall, many of the resulting jobs will not appear in the utility sector.

Low-Income Households

AB 32 recognizes the importance of ensuring that efforts to reduce greenhouse gases do not produce disproportionate impacts on low-income communities. To assess the impacts on low-income households, we analyzed how implementation of the Recommendation in the Plan would affect per capita income, household expenditures, and jobs. With the Plan in effect the average income per capita changed very little for all income groups compared to the business-as-usual scenario. Further, our analysis indicates increased job opportunities for lower skilled workers (approximately 50,000 additional low-wage jobs in 2020) and lower overall household expenditures driven by greater energy efficiency. As a result, the analysis concludes that the overall impacts of the Recommendation will be positive for low-income households in California.

Small Business

AB 32 also recognizes the key role that small businesses play in California's economy. To assess the impacts that implementation of the Scoping Plan would have on small businesses in the state, we analyzed how changes in energy expenditures would affect the competitiveness and profitability of small business. To establish those impacts, we drew upon a recent study that demonstrates that implementing a set of policies similar to those recommended in the Plan would decrease the average electricity bill by 5 percent in 2020. Our analysis indicates that small businesses will experience a slight net economic benefit as a result of lower energy expenditures along with a similar rise in the national competitiveness level of California businesses measured according to the percentage of revenue expended on electricity.

Green Technology Leadership

The development of green technologies and a workforce trained to design, develop and deploy them will be key to the success of California's efforts to reduce greenhouse gas emissions. Our state is already benefitting from the influx of investment capital in green technology. In the second quarter of 2008, California dominated the world investment in

clean technology venture capital, receiving $800 million of the global total of $2 billion. This places us well ahead of any other state, even though other states, such as Massachusetts and Florida, are now undertaking similar efforts to capture clean technology investment. Taking charge of our state's energy destiny provides California with a key opportunity to create and maintain a steady stream of 21st century jobs, and to continue our lead ahead of other forward-looking states.

The Cost of Inaction

This economic analysis deals only with the economic impacts of the implementation of the Recommendation in the Plan. It does not address other potential costs to California that will directly result from inaction under the business-as-usual case. Doing nothing places California at economic risk from a variety of perspectives. We will continue to be at the mercy of foreign imports of petroleum and the vagaries of the international oil market. We could lose our competitive edge as the nation's technology leader and magnet for venture capital in the field of clean energy technology. And, by doing nothing, California will fail to do its part to help prevent the most severe impacts of climate change, such as reduced snowpack and disruption of water supplies, rising sea level and escalated coastal erosion, increased pollution in our cities, longer and more severe heat waves, and increased wildfire danger. It is important to keep the potential costs of adapting to such impacts in mind as a background and context for the measures and approaches analyzed here.

Peer Review and Next Steps

As part of our effort to develop the most complete picture possible of the economic impacts of state greenhouse gas emission reduction policies, the Economic Analysis of the Draft Scoping Plan was submitted to an independent panel for peer review. In addition to the formal peer review, the economic analysis and related ongoing work also was reviewed by the Climate Action Team.

Conclusion

The Scoping Plan Recommendation contains a robust and effective mix of approaches and takes advantage of the strengths each approach offers. It calls for the deployment of efficient technologies and strategies which will both reduce emissions and save consumers money. Performance standards with market mechanisms will further allow regulated businesses to meet those standards in the most efficient and profitable manner. A multi-sector cap-and-trade program will provide a strong financial incentive for both producers and consumers to search out and pursue the most cost-effective emissions reduction opportunities in ways that will achieve additional savings not fully captured within the model.

The economic impact to the state is not the only consideration when choosing which path to pursue; there are other aspects and benefits to consider. In this regard, the Recommendation offers not only financial savings predicted within the model, but also assures that meaningful emission reductions will occur in *each* sector of the California economy. It creates a policy framework to maximize participation and benefits at every level of government including state, regional and local. The cap-and trade program provides further environmental and leadership benefits, including placing an absolute emission limit on capped sectors, expanding coverage of the program through the Western Climate Initiative, providing a

model for future federal programs, and creating larger markets for California's clean technology industries.

While an important part of the process of developing the Plan, the results of the economic analysis will inform, but not wholly decide the full range of measures and approaches that will constitute the Plan adopted by the Air Resources Board. Once the final Scoping Plan has been adopted, ARB will conduct further economic modeling for each of the measures pursued to inform the best design of those measures. The analysis presented here, therefore, represents the beginning, not the end, of what will be an ongoing evaluation of the best ways to achieve the goals of the overall program.

California has all of the ingredients to emerge as the vanguard of 21st century economies that are built upon clean, efficient and renewable energy sources. The state has a track record of successful and transformative innovation, a strong commitment to both public and private investment in new technologies, and a history of demonstrated success in designing environmental policies that also help to foster economic growth. The results of the economic analysis clearly show that California can achieve the goals of Global Warming Solutions Act and maintain and enhance its economic and environmental leadership.

1. INTRODUCTION

California strengthened its commitment to address and respond to climate change when Governor Schwarzenegger signed Assembly Bill 32, the Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). As the lead agency for implementing AB 32, the Air Resources Board (ARB) is developing a Scoping Plan that will lay out a comprehensive set of actions designed to reduce greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, and enhance public health while creating new jobs and driving growth in California's economy.

The California Air Resources Board released the Scoping Plan on October 15, 2008. The Plan provides a Recommendation that includes a mix of strategies that combine market mechanisms, regulations, voluntary measures, fees, and other policies and programs to reduce greenhouse gas emissions. Key elements of California's Recommendation for reducing California's greenhouse gas emission levels to 1990 levels by 2020 include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide renewables energy mix of 33 percent;
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;
- Establishing targets for transportation-related greenhouse gas emissions for regions throughout California and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.

Virtually every sector of California's economy will play a role in reducing greenhouse gas emissions. Implementation of the Scoping Plan will require our state's industrial, commercial and consumer sectors to invest in new, more efficient technologies and it will put California at the forefront of forward-looking economies that will be driven by clean, safe and secure energy sources.

This Appendix summarizes our evaluation of the economic costs and benefits associated with the measures set out in the Recommendation of the Scoping Plan. As is further discussed below, available models and related cost estimation methods tend to underestimate the important cost-saving features inherent to market-based policies such as the proposed cap-and-trade program and the market-based compliance mechanisms included in the clean car standards and the low carbon fuel standard. As a result, we have had to adapt the available

tools to approximate the Recommendation, with the result that the likely costs of achieving the targeted reductions are likely to be overstated.

Next Steps

We are requesting comments on this Appendix along with comments on the Plan itself. Staff will provide an update to the Board meeting, as needed, to respond to comments received on the economic analysis of the Scoping Plan. The economic impact of the proposal will be one of a number of factors that the Board will weigh when it considers adoption of the Plan at its December hearing.

Even after Board approval, the measures in the Scoping Plan will undergo additional development and refinement. The measures in the Scoping Plan must be adopted through the normal regulatory or other formal processes, with the necessary analysis and public input. Most of the measures included in the Scoping Plan do not yet have fully developed implementation details, so the information currently available regarding their costs and savings is necessarily preliminary. Further economic analysis will be conducted when ARB and other agencies move to adopt regulations or programs to implement the measures.

Structure of the Analysis

The evaluation summarized here relied primarily on a macroeconomic model of California, using current estimates of the costs and savings of the various measures being analyzed. In addition to considering the macroeconomic impacts of the Recommendation on California, other impacts are considered, including: preliminary evaluation of the potential effects on low-income households, other households, and businesses, particularly small businesses.

The following subsection summarizes the model we used to perform the analysis. Section 2 presents the results both from a macroeconomic perspective and in relation to certain sectors including households and small businesses. Section 3 presents an analysis of the "Greentech" sector and the role it will play in California's greenhouse gas reduction efforts. Section 4 describes the peer review procedure that the economic analysis will undergo. Section 5 summarizes our overall findings and outlines the path forward.

1.1 Summary of Models

This section outlines the modeling approach employed and the model used. (A summary of the costs and savings of the measures that were modeled and a full description of the model and are included in Appendices G-I and G-II; additional documentation of the calculation of the cost and savings estimates are included in Appendix I.) In large part, the results of any macroeconomic analysis are driven by the input assumptions; our cost and savings estimates that constitute many of these inputs are based on the best information available to staff. As with all elements of this analysis, we welcome stakeholder comment on these estimates. In addition to the models and modeling analysis described in this supplement, we will also review any stakeholder analyses of the Scoping Plan policies. We believe that obtaining results from additional models and methodologies will help to further inform the assessment of potential impacts of the Scoping Plan policies on California's economy.

Macroeconomic Modeling

The primary economic analysis was conducted using the Environmental Dynamic Revenue Assessment Model (E-DRAM). This is a 'general equilibrium macroeconomic model' of the California economy, meaning that it calculates changes in the prices of goods and services and factors of production in the economy in such a way that the total quantity demanded and supplied is kept in balance – in equilibrium. As a result, it is possible to track the flow of money from one sector to another when a specific policy is set in place. E-DRAM was originally developed for use by the California Department of Finance and was subsequently refined to assess the impacts of environmental regulations.[1] ARB has used E-DRAM for several years for a variety of economic assessments, including evaluation of the potential economic impacts on California associated with the State Implementation Plan for the Clean Air Act and the greenhouse gas motor vehicle regulations developed in response to AB 1493. E-DRAM was also used for the macroeconomic analysis of the Climate Action Team (CAT) report.[2] More background on E-DRAM and a full description of the modeling results can be found in Appendix G-II.

Professor David Roland-Holst, of UC Berkeley, also ran the Berkeley Energy and Resources Model (BEAR) to analyze the preliminary recommendation included in the Draft Scoping Plan. The results of this analysis were included in Appendix III of the Economic Analysis Supplement that was released in September 2008. Because of the short time between release of the supplement and of this appendix and the similarity of the results from E-DRAM and BEAR in the supplement, Professor Roland-Holst did not provide an additional evaluation of the Recommendation in the Plan.

E-DRAM is a macroeconomic model that characterizes the flow of production, consumption, investments and savings throughout the economy in response to policies. In order to model the measures being evaluated, the estimated costs and savings must be mapped to the applicable sectors in the model. This is an important step because the relationship that sectors have with one another describes how dollars flow throughout the economy. The relationships on how dollars flow throughout the economy are defined in a Social Accounting Matrix discussed further in the appendices.

The input assumptions for E-DRAM were based on cost and savings assumptions for the individual measures in the Scoping Plan developed by staff from the ARB and other state agencies. The costs and savings of each measure were analyzed using a standard ARB methodology to consider costs, savings, and cost-effectiveness of its proposed regulations for the past three decades. (Additional information on these estimates is provided in Appendix G-I and in Appendix I.)

The modeling results are highly sensitive to the input assumptions. As previously mentioned, the measure-by-measure cost estimates represent the best information currently available to the ARB. The level of detail on the costs and saving for the different measures

[1] The Department of Finance itself does not generate long-term economic projections for the entire California economy; however, its demographic forecasts are used as inputs to E-DRAM.
[2] Climate Action Team Economics Subgroup, "Updated Macroeconomic Analysis of climate Strategies Presented in the March 2006 Climate Action Team Report – Final Report," October 2007. http://climatechange.ca.gov/climate_action_team/index.html

included in the Scoping Plan vary widely. Some of the measures are in the later stages of regulatory development, and as a result, costs and savings estimates were readily available. For other measures that have yet to undergo the full regulatory process, costs and savings were specifically estimated for the Scoping Plan.

Energy Sector Modeling

ARB has also been working with a third model, ENERGY 2020, developed by System Solutions Incorporated (SSI). In response to a competitive solicitation, ICF International and its subcontractor, SSI, were selected to support a more detailed analysis of the economic impact of energy-related measures using the ENERGY 2020 model. This modeling analysis would have provided another perspective to supplement the E-DRAM results.

However, at this time no results are available from ENERGY 2020 because the model has not yet been fully calibrated. The calibration effort consists of harmonizing the ENERGY 2020 model with a business-as-usual case consistent with California-specific projections for emissions as well as demand for energy sources (e.g., gasoline). The calibration effort has required several more months of work than anticipated and, as indicated, is still underway. ARB has also been working with the contractor to incorporate detailed California-specific measure descriptions into the model. Although the methodology to integrate ENERGY 2020 and E-DRAM has been developed (i.e., mapping ENERGY 2020 outputs to E-DRAM inputs so that the models can work together), the calibration of investment and fuel expenditures has not been completed. Thus, ENERGY 2020 was not used in the analysis of the Scoping Plan, but is expected to help inform the subsequent regulatory phase of the program. ARB continues to work with ICF International and its subcontractor, SSI, to further refine and calibrate the ENERGY 2020 model and prepare it for evaluation of future regulations and policy designs.

1.2 Challenges in Modeling Market-Based Approaches

The primary insight to be gained from our macroeconomic modeling is the combined net beneficial impact of the set of recommended policies and measures embodied in the Recommendation on the California economy, taking into account their interaction and the shifting of economic activity across sectors. For the reasons outlined below, however, such models understate the benefits associated with market-based polices, and thus also likely understate the full range of the beneficial impacts.

1.2.1 Limitations of Available Models

Macroeconomic models such as E-DRAM are well suited to analyzing the economy-wide impact of a set of recommended policy measures, taking into account their interaction and the shifting of economic activity across sectors. As noted above, E-DRAM has been used in this fashion for a variety of past economic assessments.

Such models face several challenges in attempting to model market-based policies. First, the macroeconomic tools do not have the ability to predict how firms might invest in cost-effective energy efficient technologies that will result in reduced greenhouse gas emissions and reduced energy-related expenditures. Such cost-saving investments can only be reflected if they are specified in advance as inputs to the

model. This can be done for specific investments and measures for which the costs and savings have been estimated.

But available models do not have a mechanism to properly determine the nature or costs of "unspecified reductions" that are anticipated due to the broad flexibility allowed by a cap-and-trade program. By their very nature, such reductions cannot be attributed in advance to any specific measures or even source type. In order to produce additional unspecified reductions, the models simulate a more costly alternative. They adjust each sector's output and resulting emissions by adjusting prices of products so that they reflect the cost of GHG emissions (based upon calculated allowance prices) until the required emissions reductions are achieved. Consequently, emissions reductions in the model occur in response to reduced demand induced by increased prices. This provides an inaccurate picture that overestimates the costs of how a cap-and-trade program would operate in practice, since it fails to account for new investment that could increase efficiency and produce emissions reductions either at a net savings or lower cost.

In addition, the macroeconomic models operate at the sector level and, therefore, do not have the ability to capture the heterogeneity of facility-level emission reduction opportunities, that is, the full range of options for reducing greenhouse gas emissions available at individual facilities throughout the state. One of the primary advantages of market-based policies is that they take advantage of this heterogeneity—both in terms of variety of existing options and range of ability to innovate—to minimize costs.

Such savings have been documented by empirical studies. As was noted by the Market Advisory Committee, "This potential for cost savings is not simply a theoretical proposition. Studies indicate substantial cost savings from existing cap-and-trade programs. The two major studies of cost savings for the SO2 program[3] are in general agreement that savings under the trading program amounted to 43–55 percent of expected compliance costs under an alternative regulatory program that imposed a uniform emission standard. Carlson et al. cite savings of over 65 percent compared to a policy that might have forced post-combustion controls (scrubbers) to achieve the same level of emissions."[4] However, the models and related cost estimation methodologies treat all facilities within a sector as similar and therefore do not capture the cost reducing benefits of market-based policies that these studies have demonstrated.

Moreover, the models do not fully capture how individual consumers can and will take steps to pursue lower cost options. This is being observed today as consumers change driving habits and make greater use of public transit, carpooling and biking in response to gasoline price increases. In addition, over time, market-based approaches

[3] Carlson, C., Burtraw, D., Cropper, M. & Palmer K.L. (2000). Sulfur Dioxide Control by Electric Utilities: What are the Gains from Trade? The Journal of Political Economy, 108(6), 1292-1326; Ellerman, A. D. (2003). Lessons from Phase 2 Compliance with the U.S. Acid Rain Program. Working Paper 03-009. Cambridge: MA: Massachusetts Institute of Technology Center for Energy and Environmental Policy Research.

[4] Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California, Recommendations of the Market Advisory Committee to the California Air Resources Board, June 30, 2007, p. 7.

provide an incentive to find innovative ways to reduce emissions beyond the level necessitated by an individual firm under a performance standard. Again, available models do not capture how such innovation can reduce cost.

Other modeling tools can provide a more detailed look at the cost reduction options available to facilities. For example, ENERGY 2020 and similar models allow for an investment in improved energy efficiency as a way to achieve emission reductions. These models also treat all facilities in a sector the same with the exception of the utility sector, which in some models is represented at the individual power plant level. In general they face the same inability to capture market-oriented cost savings resulting from facility-level decisions.

1.2.2 Approach Used to Address Limitations

The Recommendation in the Scoping Plan incorporates a regulatory-based cap-and-trade program that links with the Western Climate Initiative, as well as a number of sector-based regulatory measures, many of which make extensive use of market mechanisms. Our assessment of the economic impact of the Recommendation is subject to the limitations of the models noted above with a resultant underestimation of benefits.

Given those limitations, we have approximated the operation of the cap-and-trade program as well as possible with the available modeling tools. For example, to capture how facilities might make technology changes to reduce emissions, the costs and savings of known efficiency measures were identified so that the cost per ton for reductions from those measures could be compared to carbon prices under a cap-and-trade program as modeled by E-DRAM. As a proxy for the types of actions that facilities would take in a cap-and-trade program, it is then assumed that facilities will choose to implement measures that cost less than the anticipated carbon price, to the extent they have been identified.

This approach provides a conservative approximation of how a portion of the reductions will be achieved by facilities covered by the cap-and-trade program. This technique partially addresses the model's lack of an internal mechanism to identify efficiency measures, but cannot fully eliminate it. Further, the model does not allow for the impact of innovation on cost reduction, and does not reflect the variety of emission reduction opportunities at the individual facility level.

Keeping these limitations in mind, our estimate of the economic impact of the Recommendation will understate the benefits of the market-based policies—including the cap-and-trade program—and therefore will understate the positive impact of the Recommendation on the California economy. We nevertheless believe that the estimate provides useful information for evaluating the Recommendation and is a reasonable application of the model.

1.2.3 Valid Comparison of Approaches Not Possible

The limitations of the available modeling tools noted above prevent a comparison between market-based approaches and alternative strategies, such as one that relies

only on direct regulation. It is worth noting that, to our knowledge, no previous work has made such a comparison in any rigorous way that incorporates the costs and savings of specific reduction measures. Other studies have either only modeled variations on one approach – typically one that includes market-based measures – or have used a broad-brush surrogate for a regulatory approach, such as uniform percentage reductions employed at the sector level, rather than incorporating the detailed cost and savings information from individual measures.

It is important to understand, as well as possible, the potential impacts of the various options available, and we devoted considerable time and effort to analyze alternatives to the Recommendation. We have ultimately concluded that tools are not available to make a valid comparison of one approach to the others, in great part because of the inability of the model to capture the benefits of the market mechanism measures. While results of analysis of alternative approaches were included in the appendices to the Economic Analysis Supplement to the Draft Scoping Plan, the analysis presented here focuses solely on the Recommendation in the Scoping Plan.

1.3 Western Climate Initiative Modeling Activity

The Scoping Plan recommends that California develop a cap-and-trade program that links to the broader regional market being developed by the Western Climate Initiative (WCI). In order to examine the economic impacts of WCI program design options, WCI Partner jurisdictions contracted with ICF International and SSI to perform economic analyses using ENERGY 2020, a multi-region, multi-sector energy model. The WCI work, as is appropriate for a multi-state analysis, is analyzing broad greenhouse gas reduction policies applied uniformly across the region rather than incorporating state by state specific implementation details. The WCI economic modeling results are reporting in full in Appendix D and they are discussed in the Background Report on the Design Recommendations for the WCI Regional Cap-and-Trade Program, also included in
Appendix D.

To help inform the program design process, the WCI analysis examined the implications of key design decisions, including: program scope; allowance banking; and the use of offsets. Due to time and resource constraints, the modeling was limited to the eight WCI Partner jurisdictions in the Western Electric Coordinating Council (WECC) area, thereby excluding from the analysis three Canadian provinces, Manitoba, Quebec, and Ontario. Future analyses are planned that will integrate these provinces so that a full assessment of the WCI Partner jurisdictions can be performed.

The WCI website (http://www.westernclimateinitiative.org/Economic_Analysis.cfm) contains an overview of the modeling and analysis. The main inputs to ENERGY 2020 are presented in the Assumptions Book for ENERGY 2020, which is being updated as the analysis proceeds, and is also posted on the WCI website. The inputs include:

- Historical energy consumption data by sector;
- Forecasts of fuel prices through 2020;
- Population forecasts by state and province through 2020; and,
- Forecast of economic growth by sector, and by state and province through 2020.

The WCI partners' analysis incorporated a set of policy assumptions into the reference case against which the cap-and-trade programs would be evaluated. These policy assumptions include:

- Energy efficiency, fuel standards, and automobile fuel efficiency (CAFE) standards from the Energy Independence and Security Act; and,
- Existing renewable portfolio standards adopted in the WECC states and provinces.

Additionally, the reference case incorporates assumptions regarding the availability and cost of various electric generating technologies and emission control technologies, including fossil fuel-fired generation (oil, gas, and coal) and wind, solar, biomass and geothermal generation.

The WCI modeling work is not directly comparable to the ARB results reported here. The WCI analysis relies on a more aggregated set of GHG emission reduction measures rather than the specific individual policies recommended in the Scoping Plan; it uses somewhat different assumptions regarding the "business-as-usual" case, and it models the entire WECC rather than California. Nevertheless, the results of the WCI modeling provide useful insight into the economic impact of greenhouse gas emission reduction policies.

Consistent with the conclusions of the ARB evaluation, overall, the WCI analysis found that the WCI Partner jurisdictions can meet the regional goal of reducing emissions to 15 percent below 2005 levels by 2020 (equivalent to the AB 32 2020 target) with small overall savings due to reduced energy expenditures exceeding the direct costs of GHG emission reductions. The savings are focused primarily in the residential and commercial sectors, where energy efficiency programs and vehicle standards are expected to have their most significant impacts. Energy-intensive industrial sectors are estimated to have small net costs overall (less than 0.5 percent of output).

The WCI analysis does not examine the potential macroeconomic impacts of the costs and savings estimated with ENERGY 2020. The WCI Partner jurisdictions are planning to continue the analysis so that macroeconomic impacts, such as income, employment, and output, can be assessed. Once completed, the macroeconomic impacts can be compared to previous studies of cap-and-trade programs considered in the United State and Canada.

2. SUMMARY OF MACROECONOMIC ANALYSIS RESULTS

To evaluate the economic impacts of the Scoping Plan, we compare estimated economic activity under a business-as usual (BAU) case to the results obtained when the policies in the Recommendation are implemented. The BAU case and the Recommendation are briefly described below and discussed in greater detail later in this section. The estimated costs and savings used as model inputs for individual measures are outlined in Appendix G-I. Additional detail for all of the individual measures contained in the Scoping Plan can be found in Appendix C of the Plan, and more detail on the calculation of the costs and savings for the measures is included in Appendix I of the Plan. All monetary estimates are in 2007 dollars.

Under the business-as-usual (BAU) case described below, Gross State Product (GSP) in California is projected to increase from $1.8 trillion in 2007 to around $2.6 trillion in 2020. The results of our economic analysis indicate that the Recommendation in the Scoping Plan will have an overall positive, net economic benefit for the state. Positive impacts are anticipated primarily because the investments motivated by several measures result in substantial energy savings that more than pay back the cost of the investments at expected future energy prices.

Business-as-Usual (BAU) Reference Case

The business-as-usual case is a representation of what the state of the California economy would be in the year 2020, assuming that none of the measures included in the Scoping Plan are implemented. While a number of the measures in the plan will be implemented as the result of existing federal or state policies and do not require additional regulatory action resulting from the implementation of AB 32, we do not include them in the BAU case to ensure that the economic impacts of all of the measures in the Scoping Plan are fully assessed.

The BAU case is not generated by the E-DRAM or BEAR models. Rather, the BAU case is constructed using several forecasts from other sources. Additional information about these sources can be found in Appendix G-II. Aspects of the BAU case are subject to uncertainty, for example to the possibility that future energy prices could deviate from those that are included in the BAU case. No sensitivity analysis is presented in this document, but ARB is exploring appropriate methods to incorporate sensitivity analysis in future work.

Recommendation

The Recommendation in the Scoping Plan includes measures related to energy efficiency, alternative fuels and high global warming potential gases, and a regulatory-based cap-and-trade program that together reduce emissions by 174 $MMTCO_2E$. The key measures providing the reductions include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide renewables energy mix of 33 percent;
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;
- Establishing targets for transportation-related greenhouse gas emissions for regions throughout California and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.

2.1 Impact of the Scoping Plan on California's Economy

Table G-1 summarizes the modeling results. Several economic indicators are shown for 2007 and for the 2020 model results from the business-as-usual (BAU) case and the Recommendation. Though the model results include other metrics, Gross State Product, personal income, and employment have historically been determined to be most useful for evaluating the macroeconomic impacts of policies and economic well-being. Under the BAU case, Gross State Product increases by $775 billion between 2007 and 2020, personal income grows by 2.8 percent per year from $1.5 trillion in 2007 to $2.1 trillion in 2020, and employment grows by 0.9 percent per year from 16.4 million jobs in 2007 to 18.4 million jobs in 2020.

As noted above, macroeconomic models will understate the benefits of market-based policies, including the cap-and-trade program. Consequently, our estimate of the economic impact of the Recommendation understates the positive impact on the California economy. Nonetheless, using the current best estimates of the costs and savings of the measures, the models demonstrate that the Recommendation has a positive effect on Gross State Product, personal income, and employment. For example, Gross State Product and personal income are projected to increase slightly more than they would in the BAU case, by about 0.3 and 0.8 percent, respectively, and employment is also projected to experience an increase of 0.6 percent. The modeling results indicate that California can meet the ambitious AB 32 target while maintaining and enhancing economic growth.

Table G-1: Summary of Economic Impact Modeling of the Scoping Plan Using E-DRAM

Economic Indicator	2007	Business-as-Usual[1]	Recommendation[2]
Real Output ($Billion)	2,535	3,597	3,630
Gross State Product ($Billion)	1,811	2,586	2,593
Personal Income ($Billion)	1,464	2,093	2,109
Income Per Capita ($Thousand)	38.6	47.56	47.76
Employment (Million Jobs)	16.41	18.41	18.53
Emissions ($MMTCO_2E$)	500[3]	596	421
Carbon Prices (Dollars)	-	-	10.00

[1] Business-as-usual is a forecast of the California economy in 2020 without implementation of any of the measures recommended in the Scoping Plan.
[2] Includes all measures in the Recommendation in the Scoping Plan, plus additional emission reduction options expected to be undertaken because they are estimated to have a cost-per-ton lower than the market price, as a proxy for reductions from the cap-and-trade program
[3] Approximate value. ARB is in currently estimating GHG emissions for 2007.

The economic impacts of the Scoping Plan are expressed as changes from a business-as-usual estimate of California's economic growth. As noted, the BAU case assumes that none of the measures included in the Scoping Plan are implemented. As Table G-2 below indicates, in the BAU case Gross State Product is projected to grow by about 2.7 percent annually to a value of nearly $2.6 trillion by 2020. Personal income is projected to grow by approximately 2.8 percent annually and job growth is also expected to continue as we move toward 2020.

Table G-2: Business-as-usual Case for California Economy

Economic Indicator	2007	2020	Change	Average Annual Growth (%)
Real CA Output ($Billions)	2,535	3,597	1,062	2.7%
Gross State Product ($Billions)	1,811	2,586	775	2.8%
California Personal Income ($Billions)	1,464	2,093	628	2.8%
Income Per Capita ($1000)	38.6	47.6	9	1.6%
Employment (Millions)	16.41	18.41	2	0.9%
Emissions ($MMTCO_2E$)	500[(1)]	596	96[(1)]	1.4[(1)]

[1] Approximate value. ARB is currently estimating the GHG emissions for 2007.

Table G-3 shows how implementation of the Recommendation would affect California's economy relative to a business-as-usual growth trajectory between now and 2020. As indicated in the table, the effects on output, personal income and employment are small but positive. Total output, which represents production activity in the state, increases by 0.9 percent over BAU. This translates into an increase of approximately $33 billion in 2020,

which is a relatively minor increase when evaluated in the context of a $3.6 trillion economy, but still positive nonetheless. Also represented in Table G-3 are the impacts of the Recommendation on Gross State Product, personal income, income per capita, and employment. In each case, the modeling shows a similar positive, but small, impact.

Table G-3: E-DRAM Estimates of Economic Impacts of the Scoping Plan Recommendation

Economic Indicator	BAU Case	Preliminary Recommendation	Change	% Change
Real Output ($Billions)	3,597	3,630	33	0.9%
Gross State Product ($Billions)	2,586	2,593	7	0.3%
Personal Income ($Billions)	2,093	2,109	16	0.8%
Income Per Capita ($1000)	47.56	47.76	0.2	0.4%
Employment (Millions)	18.41	18.53	0.12	0.7%
Emissions ($MMTCO_2E$)	596	422	174	-29%
Carbon Price (Dollars)	NA	10.00	NA	NA

The positive impacts are largely attributable to savings that result from reductions in expenditures on energy. These savings translate into increased consumer spending on goods and services other than energy. Many of the measures entail more efficient use of energy in the economy, with savings that exceed their costs. In this way, investment in energy efficiency results in money pumped back into local economies. Table G-4 summarizes the energy savings that are projected from implementation of the Recommendation in the Scoping Plan. These savings are estimated to exceed $28 billion annually by 2020.

Table G-4: Fuels and Electricity Saved in 2020 from Implementation of Recommendation [needs additional vmt savings of T-3]

	Gasoline	Diesel	Electricity	Natural Gas
Use Avoided[1]	4,600 million gallons	670 million gallons	74,000 GWh	3,400 million therms
Value of Avoided Fuel Use (Million $2007)	$17,000	$2,500	$6,400[2]	$2,700
Percent Reduction from BAU	25%	17%	22%[3]	29%[4]

[1] These estimates are based on reduced use of these fuels due to increased efficiencies, reduced vehicle miles traveled, etc. Changes to the fuel mix, such as those called for under the RPS or LCFS, are not included here. These estimates are not the same as the estimates of reduced fuel combustion used in the public health analysis.
[2] Based on estimated avoided cost based on average base-load electricity, including generation, transmission and distribution.
[3] This is as a percentage of BAU total California electricity consumption in 2020.
[4] This does not include natural gas used for electricity generation.

All told, the specified reduction measures in the Scoping Plan's Recommendation (not including additional unspecified reductions from cap and trade) are expected to reduce emissions of approximately 174 $MMTCO_2E$ at a net savings of about $15.4 billion, providing a positive stimulus to the economy.

When modeling the Recommendation, the model should reflect the fact that facilities will pursue emission reduction options that have a cost per ton that is lower than the market price. In the absence of complete information on what those options might be, we included in the model runs the technical options that were identified as part of the additional measures under consideration in the Draft Scoping Plan that cost less than the carbon price (other than feebates, because of the regulatory structure that would be necessary to implement that measure). The carbon price is an output of E-DRAM. The model was initially run with just the Recommended measures. The resulting carbon price was used to select additional low-cost measures to serve as a proxy for reductions resulting from the cap-and-trade program. Thus, this approach provides a rough approximation of how a portion of the reductions from the market approach would be achieved. This produces, however, an incomplete list of choices since the model does not have the capability to adequately reflect the full set of options that are available to covered sectors under cap and trade. This approach resulted in measures that provided an additional 19 $MMTCO_2E$ in reductions included in the model run of the Recommendation. Reductions for the remaining 14 $MMTCO_2E$ were then modeled using an approach that represented pricing mechanisms that moderated consumer demand. Appendix G-I provides a complete list of the measures included in this modeling run.

As a result, the modeling results presented for the cap-and-trade program of the Recommendation reflect a carbon price of $10 per ton. It is important to note that the $10 per-ton figure does not reflect the average cost of reductions; rather, it is the *maximum* price at which reductions to achieve the cap are pursued based on the market program. We will continue to evaluate these results and anticipate that modeling efforts currently underway in the Western Climate Initiative will provide useful additional information.

2.2 Impact on Specific Business Sectors

In addition to evaluating the projected statewide macroeconomic impacts of implementation of the Scoping Plan, we also modeled how implementation will affect specific sectors. E-DRAM is capable of generating information at a general level of detail that describes how specific sectors of the California economy will be affected. Additional discussion regarding how E-DRAM models sector specific impacts and the various types of industries that comprise each sector can be found in Appendices G-II and G-IV.

As indicated in Table G-5, the effects of the plan are not uniform across sectors. Implementation of the Recommendation in the Scoping Plan would have the strongest positive impact on output and employment for the agriculture, forestry and fishing sector; the finance, insurance and real estate sector; and the mining sector. Similar to the statewide economic impacts projected by the model, these results also indicate that impacts due to implementation of the plan, compared to the business-as-usual case, are still positive, and alter the current growth projections for most sectors by only very small amounts.

Table G-5 also shows that for several sectors a decrease in output and employment is projected. In the utility sector, the modeling indicates that implementation of the Recommendation would significantly reduce the need for additional power generation and natural gas consumption which subsequently reduces the growth in output for this sector. This results in a reduction from business-as-usual for both economic output and employment of approximately 17 and 15 percent, respectively, in 2020. The primary reason for these

projections is the implementation of efficiency measures and programs for both consumers and producers as described in the Scoping Plan. While increasing spending on efficiency and renewable energy is expected to increase employment, many of the resulting jobs will not appear in the utility sector.

The retail trade sector, which is projected to grow by nearly 50 percent in both the business-as-usual and the Recommendation case, is also projected to experience a slight net decline in output relative to business-as-usual. Since gasoline is considered a consumer retail purchase under this model, the reduced growth is mostly due to the decrease of approximately $19 billion in retail transportation fuel purchases, which is largely offset by the $14 billion increase in spending at other retail enterprises.

Table G-5: **E-DRAM Estimates of Sector Specific Economic Impacts of the Recommendation**

	Output ($Billions)				Employment (thousands)			
Sector	**2007**	**BAU**	**Rec**	**Percent Change from BAU**	**2007**	**BAU**	**Rec**	**Percent Change from BAU**
Agriculture, Forestry and Fishing	76	109	113	3.9%	398	449	464	3.5%
Mining	27	29	31	7.2%	26	26	26	1.3%
Utilities	51	72	60	-16.7%	60	67	57	-14.7%
Construction	114	164	166	1.7%	825	929	934	0.5%
Manufacturing	673	943	948	0.5%	1,821	2,046	2,057	0.5%
Wholesale Trade	120	171	173	1.0%	703	791	793	0.1%
Retail Trade	207	296	291	-1.6%	1,688	1,901	1,916	0.8%
Transportation and Warehousing	76	109	111	1.9%	447	503	510	1.2%
Information	164	235	238	1.1%	398	448	450	0.4%
Finance, Insurance and Real Estate	391	559	572	2.3%	911	1,026	1,046	2.0%
Services	636	910	927	1.9%	5,975	6,729	6,773	0.7%
Government	-	-	-	-	3,100	3,491	3,502	0.3%
Total	**2,535**	**3,597**	**3,630**	**0.8%**	**16,352**	**18,405**	**18,528**	0.6%

2.3 Household Impacts

Our analysis also included an evaluation of how households in California would be affected by the implementation of AB 32, particularly low- and middle-income households. The results indicate that both low- and middle-income households will realize savings on the order of a few hundred dollars per year in 2020, compared to the business-as-usual case, primarily as a result of increased energy efficiencies.

2.3.1 Low-Income Households

Based on current U.S. Department of Health and Human Services poverty guidelines, we evaluated the projected impacts of the plan on households with earnings at or below both 100 and 200 percent of the poverty guidelines. For the typical household of three members, an income of $17,600 corresponds to 100 percent of the poverty level and an income of $35,200 corresponds to 200 percent of the poverty level.[5] For all households, including those with incomes at 100 percent and 200 percent of the poverty level, implementation of the Recommendation produces a slight increase in household income relative to the business-as-usual case.

At the same time, the analysis projects a small increase in the number of jobs available for lower-income workers[6] relative to business-as-usual as a result of implementing the plan.

For example, implementation of the Recommendation produces approximately 50,000 more such jobs in 2020 than there would otherwise be. The largest employment gains come in the retail, food service, agriculture, and health care fields. A decline in such jobs is projected in the retail gasoline sector due to the overall projected decrease in output from this sector. This decline is more than offset by the increases experienced in other areas, and the vast majority of workers displaced in the retail gasoline sector would not likely require any additional training or experience to transition into a new field of employment.

Another important factor to consider when analyzing the impact of the Scoping Plan on households is how it will affect household expenditures. As indicated in Table G-6, analysis based on the modeling projections estimates a savings (i.e., reduced expenditures) of around $400 per household in 2020 for low-income households under both federal poverty guideline definitions. These savings are driven primarily by the implementation of the clean car standards and energy efficiency measures in the Scoping Plan that over time are projected to outweigh potential increases in electricity and natural gas prices that may occur. As the measures in the Scoping Plan are implemented, we will work to ensure that the program is structured so that low income households can fully participate in and benefit from the full range of energy efficiency measures. Additional information regarding the data in Table G-6 can be found in Appendix G-IV.

[5] Source: Federal Register, Vol. 73, No. 15, January 23, 2008, pp. 3971-3972.

[6] Low-income jobs are defined as those with a median hourly wage below $15 per hour (2007 dollars) based on wage data and staffing pattern projections from the California Employment Development Department. The shares of low-wage occupations for each industry are then applied to the corresponding E-DRAM sector employment projections.

Table G-6: Impact of Implementation of Scoping Plan on Total Estimated Household Savings in 2020 (2007 $)

	Income at 100% of Poverty Guideline	Income at 200% of Poverty Guideline	Middle Income[1]	High Income[2]	All Households[3]
Recommendation	$400	$400	$500	$500	$500
Share of Total Expenditures	2%	2%	1%	1%	1%

[1] All households between 200 percent and 400 percent of the poverty guidelines.
[2] All households above 400 percent of the poverty guidelines.
[3] Average of households of all income levels.

The modeling indicates that implementation of the Scoping Plan is likely to result in small savings for most Californians, with little difference across income levels. Largely due to increased efficiencies, low-income households are projected to be slightly better off from an economic perspective in 2020 as a result of implementing AB 32.

2.3.2 Middle-Income Households

In addition to looking at how low-income households would be affected, we also analyzed what the projected impacts of the plan would be for a middle-income California household. For purposes of our analysis we define "middle-income" households as those earning between 200 percent and 400 percent of the federal poverty guidelines. For the average-size household in California, this equates to an annual income between $35,000 and $70,000.

As previously discussed, the analysis indicates that implementation of the plan produces a small increase in per capita income across all income levels, including middle-income households relative to the business-as-usual case. In terms of how jobs[7] for middle-income households would be impacted, the analysis indicates a slight overall increase of nearly 40,000 in 2020.

As shown in Table G-6, the analysis projects a net-savings in annual household expenditures of about $500 in 2020 for middle-income households. These savings are driven by the emergence of greater energy efficiencies that will be implemented as a result of the plan.

The results of our analysis show that implementation of the Scoping Plan will have a small, but overall positive, impact on middle-income California households. These findings are consistent with the projected impacts of the plan on low-income households and with the economy-wide modeling results as well.

[7] Hourly wage between $15 and $30 per hour, (2007 dollars), based on wage data and staffing pattern projections from the California Employment Development Department.

2.4 Small Business Impacts

Small businesses in general will not be directly affected by the measures recommended in the Scoping Plan. Any impacts will primarily come in the form of changes in the costs of goods and services that they procure, and in particular, changes in energy expenditures. Therefore, in this analysis we focus on how implementation of the Recommendation would affect the percentage of revenue small businesses spend on energy, and how this could impact their profitability and overall economic competitiveness. Additional detail regarding the methodology we used is in Appendix G-V.

Recent analysis from Energy and Environmental Economics, Inc.[8] (E3) forecasts that a package of greenhouse gas emission reduction measures similar to those contained in the Scoping Plan would deliver a 5 percent decrease in electricity expenditures for the average California electricity customer relative to business-as-usual in 2020. Changes to individual entities will deviate from the average and the E3 analysis does not predict how these savings will be distributed among customers. This projection is based on the assumption that increases in electricity prices will be more than offset by the continued expansion of energy efficiency measures and that more efficient technologies will be developed and implemented.[9] We also make a conservative assumption that expenditures on natural gas remain the same, balancing the projected 18 percent decrease in natural gas consumption in California with the model's projected natural gas price increase of 7.9 percent.

Based on this assessment, our analysis indicates that implementation of the Recommendation in the Scoping Plan will likely have minor but positive impacts on small businesses in the state. These benefits are attributable primarily to the measures in the plan that will deliver significantly greater energy and fuel efficiencies. Even when higher per-unit energy prices are taken into account, these efficiencies will decrease overall energy expenditures for small businesses. Additionally, as previously described, the California economy is projected to experience robust economic growth between now and 2020 as AB 32 is implemented. Small businesses will experience many of the benefits associated with this growth in the form of more jobs, greater production activity, and rising personal income.

The projected decrease in electricity expenditures is especially important for small businesses since they typically spend more on energy as a percentage of revenue compared to larger enterprises. For example, firms with a single employee spend approximately 3.3 percent of each sales dollar on electricity while businesses with between 10 and 49 employees spend around 1.2 percent. As a result, smaller businesses are likely to experience a greater relative benefit from decreased energy expenditures relative to their larger counterparts.

From the broader economic perspective, these changes will make California more competitive as a location for small business, moving it from 7th highest to 19th among all

[8] Based on their GHG calculator, CPUC/CEC GHG Docket (CPUC Rulemaking.06.04.009, CEC Docket 07-OIIP-01), available at http://www.ethree.com/cpuc_ghg_model.html.

[9] The E3 analysis focuses on direct programmatic measures and does not include the incremental price impact of the cap and trade program, which will depend upon allowance price, allocation strategy, the capped sector industry response and other program design decisions.

states in terms of the percentage of revenue that businesses expend on electricity.[10] As was noted above for low-income households, care must be taken to ensure that the program is structured to allow small businesses to participate in and benefit from the energy efficiency measures.

[10] Although our natural gas data is less specific, we expect a similar scenario where increased prices are typically offset by greater efficiencies for most small businesses.

3. GREEN TECHNOLOGY LEADERSHIP

The development of green technologies and a trained workforce equipped to design, develop and deploy them will be key to the success of California's long-term efforts to combat global warming. This section outlines a variety of ways in which the state's greenhouse gas emission reduction policies will support and foster green technology.

3.1 Green Technology Attracts Capital

Bold, long-range environmental policies help drive innovation and investment in emission-reducing products and services in part by attracting private capital. Typically, the private sector under-invests in research and development for products that yield public benefits. When environmental policy is properly designed and sufficiently robust to support a market for such products, private capital is attracted to green technology development as it is to any strategic growth opportunity.

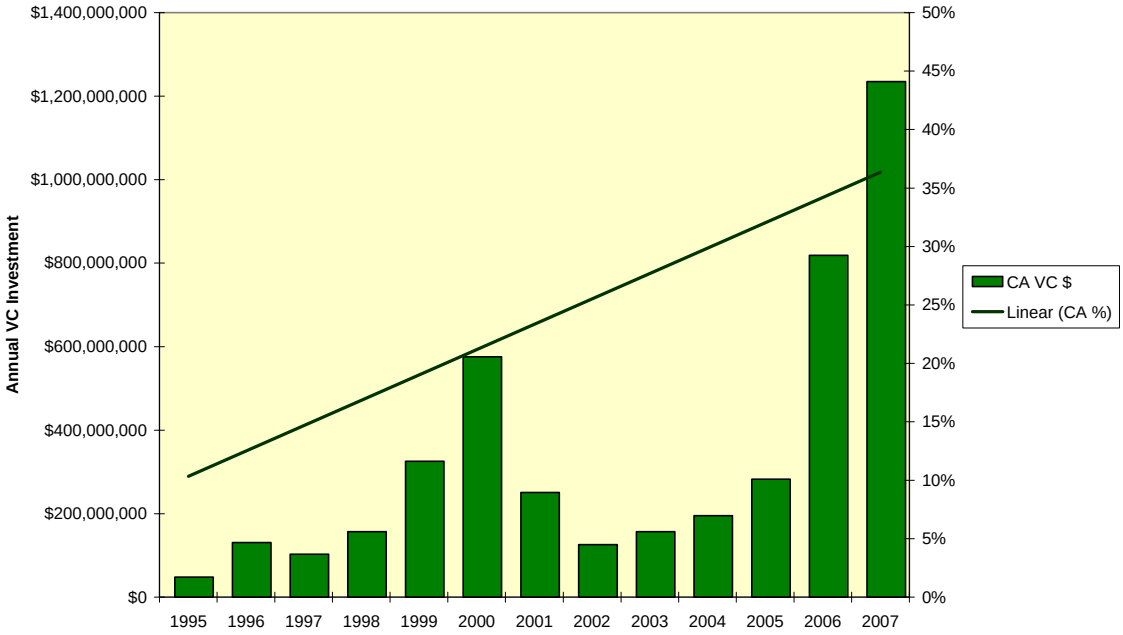
In addition to well-designed environmental policy, other factors are also important in attracting private resources to invest in technological innovation. These include the presence of adequate innovation infrastructure in the form of established centers of research and development, a physical and cultural environment that attracts the most innovative human resources, and a large-scale local market for innovative products. Where all of these other factors are present – as they are in California – state policies can have an extremely important positive impact.

California's leadership in environmental and energy efficiency policy has helped attract an increasing share of venture capital investment in green technologies. According to statistics from PricewaterhouseCoopers and the National Venture Capital Association, California's share of U.S. venture capital investment in innovative energy technologies increased dramatically from 1995 to 2007 (see Figure G-3 below).[11] The same period saw a stream of pioneering environmental policy initiatives, including energy efficiency codes for buildings and appliances, a renewable portfolio standard for energy, climate change emission standards for light duty automobiles and, most recently, AB 32. Flows of venture capital into California are escalating as a direct result of the focus on greenhouse gas reduction. According to Cleantech Network, LLC, an industry group that tracks clean technology financial trends, California captured the largest single portion of global venture capital investment ($800 million out a total of $2 billion dollars) during the second quarter of 2008.[12]

[11] Based on historical trend data for the 'Industrial/Energy' industry for California and the United States from the PricewaterhouseCoopers MoneyTree Report. https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=historical (accessed October 12, 2008).
[12] "Cleantech Venture Investment Reaches Record of $2 Billion in 2Q08", Cleantech Network, LLC, July 08, 2008.

Figure G-3

California's Growing Share of Venture Capital Investment in Energy Innovation, 1995-2007 (current $, % share)



Source: Based on historical trend data for the 'Industrial/Energy' industry for California and the United States from the PricewaterhouseCoopers MoneyTree Report. https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=historical (accessed October 12, 2008)

A survey of clean technology investors by Global Insight and the National Venture Capital Association found that public policy influences where venture capitalists invest;[13] and investments in green technology solutions produce jobs at a higher rate than investments in comparable conventional technologies.[14] Venture Capitalists estimate that each $100 million in venture capital funding helps create 2,700 jobs, $500 million in annual revenues for two decades, and many indirect jobs.[15]

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[13] Clean Tech Entrepreneurs & Cleantech Venture Network LLC. *Creating Cleantech Clusters: 2006 Update*. May 2006. p.43 http://www.e2.org/ext/doc/2006%20National%20Cleantech%20FORMATTED%20FINAL.pdf (accessed October 12, 2008)

[14] Report of the Renewable and Appropriate Energy Laboratory. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[15] Report prepared for the National Venture Capital Association. *Venture Impact 2004: Venture Capital Benefits to the U.S. Economy*. Prepared by: Global Insight. June 2004. http://www.globalinsight.com/publicDownload/genericContent/07-20-04_fullstudy.pdf (accessed October 12, 2008)

Access to capital controlled by institutional investors is also enhanced by policies that encourage early adoption of green technologies. When California-based corporations use green technologies to reduce their exposure to climate change risk, institutional investors reward them by facilitating their access to capital. The Investor Network on Climate Risk – including institutional investors with more than $8 trillion of assets under management – endorsed an action plan in 2008 that calls for:

- Requiring asset managers to consider climate risks and opportunities when investing;
- Investing in companies that develop and deploy clean technologies; and,
- Expanding climate risk scrutiny by investors and analysts.[16]

Additional capital for green technologies helps drive increased employment, both indirectly, as energy savings are plowed back into other sectors of the economy; and directly, as new green products are successfully commercialized.

3.2 Green Job Creation

The increasing emphasis on making a transition toward safer and more secure energy sources has spurred a steady rise in demand for energy efficiency and renewable energy products and services. Mainstream capital markets have started to actively seek out and embrace green business opportunities. Now an accepted investment category in capital markets, green technology portfolios routinely outperform broader market indices such as the Standard & Poor's 500 and the Dow Jones Industrial Average.[17] Alternative energy is no longer an alternative investment.

McKinsey & Company projects average annual returns of 17 percent on global investments in energy productivity, and sizes the global investment opportunity at $170 billion annually through 2020.[18] Meanwhile, global investment in energy efficiency and renewable energy has grown from $33 billion to more than $148 billion in the last four years. Beyond 2020, green technologies are expected to attract investment of more than $600 billion annually.[19] In short, green technology is now a *bona fide* global growth industry.

Today, green technology businesses directly employ at least 43,000 Californians, primarily in energy efficiency and energy generation, according to a 2008 study from the California Economic Strategy Panel. Green jobs are concentrated in manufacturing (41 percent), and professional, scientific and technical services (28 percent), with median annual earnings of

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[16] The Investor Network on Climate Risk. *Final Report, 2008 Investor Summit on Climate Risk*. February 14, 2008. http://www.ceres.org//Document.Doc?id=331 (accessed October 12, 2008)

[17] "Cleantech Venture Capital: How Public Policy Has Stimulated Private Investment" James Stack, UC Berkeley Goldman School of Public Policy , E2 Environmental Entrepreneurs, and Cleantech Venture Network, LLC, May 2007, pages.8-9

[18] McKinsey Global Institute. *The Case for Investing in Energy Productivity*. McKinsey & Company. February, 2008. p.8 http://www.mckinsey.com/mgi/reports/pdfs/Investing_Energy_Productivity/Investing_Energy_Productivity.pdf (accessed October 12, 2008)

[19] United Nations Environment Programme-New Energy Finance Ltd. *Global Trends in Sustainable Energy Investment 2008: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency* 2008. p.12 ISBN: 978-92-807-2939-9 http://www.unep.fr/energy/act/fin/sefi/Global_Trends_____2008.pdf (accessed October 12, 2008)

$35,725 and $56,754, respectively.[20] By 2030, under a moderate growth scenario, green businesses nationwide are expected to generate revenues of $2.4 trillion, (2006 dollars), and employ 21 million Americans.[21]

3.3 Energy Efficiency Jobs

As a leader in green technology development and use, California has already realized substantial economic benefits from the adoption of energy efficiency policies. State energy efficiency measures have saved enough energy over the past 30 years to avoid construction of 24 500-megawatt power plants. Today, California's per capita electricity consumption is 40 percent below the national average, and the carbon intensity of California's economy is among the lowest in the nation.[22]

Household consumption accounts for over 70 percent of Gross State Product, and household energy savings are a key driver of both employment and economic growth. As energy-efficient households shift spending from the capital intensive supply chain of the energy industry to the more labor-intensive supply chains of other products and services, more new jobs are created. As a result, net employment impacts of energy efficiency for California are strongly positive.

Building and appliance efficiency standards have saved California households more than $56 billion in electricity and natural gas costs since 1978, and increased the growth of Gross State Product by 3 percent ($31 billion) over the same period. California's Title 24 building standards are expected to produce another $23 billion in household energy savings by 2013, while California's appliance standards are projected to deliver another $25 billion in energy savings through 2020.[23]

3.4 Renewable Energy Jobs

Renewable energy—solar, wind, biomass, geothermal—will also bring new employment opportunities to Californians while spurring economic growth. Compared to other states, California enjoys significant advantages for renewable energy development. These include: concentrated innovation resources; a large potential customer base; key natural resources such as reliable insolation and wind; and supportive regulatory programs, including the California Renewable Portfolio Standard, the Million Solar Roofs Initiative, the California Global Warming Solutions Act of 2006, and the Solar Water Heating and Efficiency Act of 2007.

Other researchers have estimated that under a national scenario with 15 percent renewables penetration by 2020, California will experience a net gain in direct employment of 140,000

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[20] California Economic Strategy Panel with Collaborative Economics. *Clean Technology and the Green Economy*. March 2008. p.14-15 http://www.labor.ca.gov/panel/pdf/DRAFT_Green_Economy_031708.pdf (accessed October 12, 2008)

[21] The American Solar Energy Society. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century.* 2007. p.39 ISBN 978-0-89553-307-3 http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf (accessed October 12, 2008)

[22] California Energy Commission. *2007 Integrated Energy Policy Report*. Document No. CEC-100-2007-008-CMF. 2007. p. 3 http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CMF.PDF (accessed October 12, 2008)

[23] Ibid.

jobs by 2020.[24] Because investments in green technologies produce jobs at a higher rate than investments in conventional technologies, jobs losses that occur in traditional fossil fuel industries will be more than compensated for by gains in the clean energy sector.

Furthermore, if California's renewable energy suppliers field products that are sufficiently competitive to penetrate the export market, employment and earnings dividends for the state will also increase. California renewable energy industries servicing the export market can generate up to 16 times more employment than those that only manufacture for domestic consumption, according to a study by the Research and Policy Center of Environment California.[25]

[24] Tellus Institute and MRG Associates. *Clean Energy: Jobs for America's Future.* As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

[25] Environment California Research and Policy Center. *Renewable Energy and Jobs. Employment Impacts of Developing Markets for Renewables in California*. July 2003. As cited in: Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate? Energy and Resources Group/Goldman School of Public Policy at University of California, Berkeley. April 13, 2004. http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf (accessed October 12, 2008)

4. PEER REVIEW OF THE SCOPING PLAN ECONOMIC ANALYSIS

ARB believes that this economic analysis will benefit from an independent peer review and has taken steps, through an established independent process conducted by the California Environmental Protection Agency (Cal/EPA), to establish a peer review panel. Submission of the economic analysis for peer review can strengthen the economic assessment as well as the findings presented in the Scoping Plan. The purpose of the review is for the peer reviewers to make a determination as to whether the economic analysis is based upon sound scientific knowledge, methods, and practices. In short, the purpose of the peer review is to ensure that the scientific underpinnings of the economic analysis are based on the best science. In an effort to establish the peer review panel, Cal/EPA requested the University of California, Berkeley to initiate the process of selecting experts to review the economic analysis presented in this document. The panel will remain anonymous to the ARB and only be identified after submitting its comments.

The Economic Analysis Supplement to the Draft Scoping Plan was provided to the peer reviewers through the University of California, Berkeley. The reviewers were selected by the Berkley Institute of the Environment based on their professional experience, having distinguished themselves as experts in the field of economics with a particular focus in areas including economic modeling, market mechanisms and the economics of climate change mitigation. As part of its review the panel completed the following:

- Assess the theoretical basis of the models;
- Assess the appropriateness of the models to support the evaluation of the policy scenarios to reduce emissions of GHGs;
- Assess the key data sets (e.g., energy consumption forecasts) upon which one or more of the models rely;
- Examine the assumptions for their validity and practicality;
- Assess the key variables to which the model is most sensitive and a qualitative assessment of how alternative assumptions could impact the results;
- Assess the economic analysis of the Scoping Plan including the associated inputs and assumptions;
- Comment on the reasonableness of the models' results as well as their interpretation as presented in the analysis;
- Comment on additional analyses that ARB should consider incorporating during the implementation of the Scoping Plan; and,
- Comment on additional modeling approaches that others have done/may do in response to the Scoping Plan.

The ARB will consider the results of this peer review when it is provided and will respond as appropriate. In addition to the formal peer review, the economic analysis and related ongoing work will also be reviewed by the Climate Action Team.

5. CONCLUSION

California has boldly accepted the challenge to address climate change by developing a comprehensive program to reduce greenhouse gases. As the economic analysis presented here indicates, the Scoping Plan's Recommendation also presents us with a tremendous economic opportunity. We can implement AB 32 in a way that not only protects, but actually enhances economic growth and creates thousands of new jobs. We can grow our economy while also making it cleaner, more efficient and more secure. Many economic benefits will accompany the implementation of a comprehensive emission reduction strategy as outlined in the Scoping Plan.

Our analysis concludes that:

- California can reach its emission reduction target in a manner that is beneficial to the economy by increasing economic output, jobs and income;
- On average, consumers are expected to be better off because of the savings due to the implementation of increased energy efficiency measures in the Scoping Plan;
- All households, including low-income households, are projected to experience net economic savings due to the implementation of the plan;
- Business impacts of the Scoping Plan are positive. Several measures in the plan encourage, require or promote energy efficiency, which is likely to reduce energy costs for businesses of all sizes over time; and,
- Implementation of the plan will drive California-based technologies to the forefront of the growing global market in green technology, providing jobs and income to many Californians.

The Plan recommends an effective mix of approaches for reducing greenhouse gases and takes advantage of the strengths of each. It calls for the deployment of efficient technologies and strategies which will both reduce emissions and save consumers money. Performance standards with market mechanisms will further allow regulated businesses to meet those standards in the most efficient and profitable manner. A multi-sector cap-and-trade program will provide a strong financial incentive for both producers and consumers to search out and pursue the most cost-effective emissions reduction opportunities in ways that will achieve additional savings not fully captured within the model.

These positive economic impacts to the state are not the only consideration when choosing which path to pursue. In addition to the financial savings predicted within the model, the Recommendation also assures meaningful reductions will occur in each sector of the California economy. It creates a policy framework to maximize participation and benefits at every level of government including state, regional and local. The cap-and-trade program provides further environmental and leadership benefits including placing an absolute emission limit on capped sectors, expanding coverage of the program through the Western Climate Initiative, providing a model for future Federal programs and creating larger markets for California's clean technology industries.

Moving forward, ARB will continue to refine its economic analysis of the measures contained within the Scoping Plan as well as review the results of the peer review and other relevant modeling. Once the Scoping Plan has been adopted, ARB will conduct further economic modeling for each of the measures pursued to inform the best design of those measures. This analysis represents the beginning, not the end, of what will be an ongoing evaluation of the best ways to achieve the goals of the program.

California has all of the ingredients to emerge at the vanguard of 21st century economies that are built upon clean, efficient and renewable energy sources. The state has a track record of successful and transformative innovation, a strong commitment to both public and private investment in new technologies, and a history of demonstrated success in designing environmental policies that also help to foster economic growth. The results of the economic analysis clearly show that California can achieve the goals of the Global Warming Solutions Act of 2006 and enhance its economic and environmental leadership.

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Climate Change Scoping Plan Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Appendix G: Economic Analysis
Appendix G-I
Modeling Assumptions for Economic Analysis of the Scoping Plan

Introduction

Appendix G presents the results of the economic analysis of the Recommendation in the Scoping Plan. Staff from ARB and other agencies developed estimates of the costs and savings of those measures. The costs and savings of each measure were analyzed using a standard ARB methodology to consider costs, savings, and cost-effectiveness of its proposed regulations for the past three decades. The methodology is the annualized discounted cost analysis, further explained below.

The annualized discounted cost analysis methodology is well established and accepted, and has been used for the economic assessment of major regulations developed by ARB in recent years. For example, ARB used the methodology to analyze the costs of the Light–Duty Motor Vehicle Greenhouse Gas Standards (AB 1493, Pavley) designed to reduce greenhouse gas emissions. The methodology was also used by the Economic Subcommittee of the Climate Action Team to assess the costs, savings, and cost-effectiveness of its GHG reduction measures.[26] Several other regulatory and planning efforts have used the annualized discounted cost analysis.

The level of detail on the costs and savings for the different measures included in the Scoping Plan vary widely. Because some of the measures are in the later stages of regulatory development, their costs and savings estimates were readily available. For other measures the costs and savings were specifically estimated for the Scoping Plan. Many of these estimates are preliminary, and are likely to change during the regulatory process. For example, the costs and savings for some measures were developed, in part, by drawing from cost per ton information compiled to support related measures proposed or adopted by other organizations.

[26] Climate Action Team Economics Subgroup, "Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report – Final Report," October 2007. http://climatechange.ca.gov/climate_action_team/index.html

Cost and Savings Analysis Methodology

Applying a consistent methodology for analyzing the costs of measures is a necessary step to prepare inputs for the E-DRAM model.[27] Specifically, the methodology annualizes all costs and savings to calculate the net cost per ton of emissions reduced for each measure.

Many of the measures have up-front costs for equipment or devices that last many years, thus supporting ongoing emission reductions. The costs need to be spread over the years that the equipment operates. For example, an efficient refrigerator that costs more will provide refrigeration with less electricity and cause lower greenhouse gas emissions for 10 to 15 years. The additional cost of purchase would have to be spread over the life of the refrigerator to correspond with the refrigeration benefits to allow comparison with the savings through reduced energy consumption, which also occur over the lifetime of the refrigerator. The up-front costs for many of the measures were reported as the capital expenditures necessary to implement the measure.

Another cost factored into the analysis is the ongoing cost for operations and maintenance after a measure is implemented. In some cases, this cost may be negative, representing a savings when a measure reduces ongoing costs.

Savings are treated similarly to annualized costs if they occur up-front. However, almost all savings from the measures resulted from reduced energy use or operations and maintenance costs, and were reported as an annual amount.

The following items were included in the cost and savings information on the measures and were used in the economic modeling:

- Up-front or Capital Expenditures: investments in equipment or facilities with lifetimes of more than one year.
- Equipment Life: the period of time the equipment provides its benefits.
- Operations and Maintenance Costs: on-going costs that facilitate realization of the benefits from the installed equipment or devices.
- Energy Costs and Savings: were reported in energy units for each year and were valued using a consistent energy price forecast.
- Non-Energy Savings: reported for each year.
- Constant 2007 Dollars: used for all valuations.

[27] E-DRAM is described in more detail in Appendix G-II.

The analysis of costs and savings involved four steps. The first step is to annualize the up-front or capital expenditures using the following formulas:

$$\text{Annualized Cost of Capital} = \text{Capital Expenditures} \times \text{Capital Recovery Factor}$$

$$\text{Capital Recovery Factor} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where i is the discount rate (5%) and n is the life of the capital.

The capital expenditures developed for the proposed measures were multiplied by a capital recovery factor to give the annualized cost of capital. The capital recovery factor requires selecting a discount rate and equipment lifetime. A uniform real discount rate of five percent was used for all measures, and the equipment lifetime was estimated for each measure. The primary rationale for using a real discount rate of five percent is that it is equivalent to rate of return on an inflation-adjusted 10-year treasury security, (about 2 percent in the past five years)[28] , plus the California Environmental Protection Agency recommended 3 percent risk premium.[29] The five percent real discount rate has been used for several recent ARB regulations. Additionally, the five percent is the average of what the US Office of Management and Budget recommends (7 percent) and what US Environmental Protection Agency has used historically for regulatory analysis. The result of this first step is a levelized cost that will be incurred for every year the equipment or device operates until the capital expenditure is fully paid. This way, the costs of a measure can be matched with the annual savings and the emission reductions the measure provides.

The second step is to determine the on-going costs. These costs were reported as operating and maintenance costs for most of the measures for each year of the equipment life.

The third step is to calculate the value of the energy savings. Many of the measures reduce gasoline, diesel, natural gas, or electricity usage. The savings for each fuel were valued at the prices forecasted by California Energy Commission. The forecast prices for 2020 are displayed in Table G-I-1.

[28] http://www.federalreserve.gov/releases/h15/data/Annual/H15_TCMII_Y10.txt
[29] Cal/EPA Management Memorandum: Implementation of 1993 Regulatory Reform Legislation.

Table G-I-1: Forecasted Energy Prices Used in Estimating Measure Costs and Savings (2007 $)

Energy Type	Price	Metric
Electricity avoided cost 2020[(1)(2)]	$86.09	Per MWh
Natural gas avoided cost 2020[(2)]	$7.94	Per MMBtu
Gasoline price 2020[(3)]	$3.673	Per gallon
Diesel fuel price 2020[(3)]	$3.685	Per gallon

1 8,760 average price for avoided generation and T&D costs
2 Source: Updated from Climate Action Team (CAT) Report, updated to 2007 dollars
3 Source: California Energy Commission, Table B-3 of *Transportation Energy Forecasts for the 2007 Integrated Energy Policy Report*, September, 2007, CEC-600-2007-009-SF (http://www.energy.ca.gov/2007publications/CEC-600-2007-009/CEC-600-2007-009-SF.PDF).

The last step is to calculate the net cost for each measure. The net cost was the sum of annualized capital costs, operating and maintenance costs, value of energy savings, and other savings. Some measures, particularly the energy efficiency measures, had negative net costs (i.e. a net savings). Others had positive net costs, meaning that the costs exceeded savings. The costs and savings for the Scoping Plan measures are displayed in Tables G-I-2. Table G-I-3 lists the measures that were identified as part of the cap-and-trade implementation adopted by the market forces without regulation. Additional details on the derivation of the cost and savings estimates for each measure are provided in the Appendix I of the Scoping Plan, the Measure Documentation Appendix.

Cost-Effectiveness

AB 32 requires the Board to consider cost-effectiveness of the measures when adopting the Scoping Plan, and defines cost-effectiveness as, "the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential." (H&S Code 38505 (d)) This definition specifies using a metric of cost per unit of reductions emissions (e.g. dollars per metric ton CO_2E) by which the Board must express cost-effectiveness, but it does specify what should be included in the cost calculation and does not provide criteria to assess if a regulation is or is not cost-effective. In addition to reducing greenhouse gas emissions, some of the measures will provide co-benefits by reducing emissions of criteria pollutants (e.g., particulate matter, ozone precursors). Therefore, when conducting more detailed analyses as part of the regulatory process, ARB staff plan to account for the value of the co-benefits by reducing the estimated cost of the greenhouse gas emission reduction measures by the average cost of control for the criteria pollutants reduced as a co-benefit. This method is consistent with the approach used in the macroeconomic impact analysis of the Climate Action Team Report. However, this accounting for co-benefits has not been included as part of the analysis conducted for the Scoping Plan.

To achieve the AB 32 2020 emission limit, ARB has estimated that emission reductions from business-as-usual of 174 $MMTCO_2E$ will be needed. The Preliminary Recommendation in the Scoping Plan achieves these reductions through a broad spectrum of measures, including

performance-based regulations and a California cap-and-trade program linked to a western regional market.

Tables G-I-2 and G-I-3 present estimated costs and savings of the recommended greenhouse gas reduction measures as well as other measures under evaluation. The last column in both tables shows the cost-effectiveness (i.e. net annualized cost per ton of CO_2E emissions reduced) of each measure as currently estimated. As previously indicated, many of the measures are in the early stages of development. It is anticipated that as the analysis proceeds and the measures move through the regulatory process the costs for some will change; some will increase while others will decrease.

A number of measures included in the Scoping Plan provide greenhouse gas reduction benefits, but are being pursued for other policy reasons. For example, the ship electrification (T-5) and goods movement measures (T-6) are being pursued to achieve reductions in criteria air pollutants and toxic air contaminant emissions. While the greenhouse gas emission reductions that result will help California achieve the 2020 target, ARB is not attributing the costs or savings that result from these measures to implementation of AB 32. For this reason, these measures, along with the high speed rail measure (T-9), the California solar programs measure (E-4), and the solar hot water heater measure (CR-2) all show zero costs and zero savings in the tables below.

Table G-I-2: Costs, Savings, and Dollars Per Metric Ton of CO_2E Reduced Recommended Greenhouse Gas Reduction Measures

	Measures	Reductions ($MMTCO_2E$ in 2020)	Costs ($Millions)	Savings ($Millions)	Net Cost or Savings Per $MTCO_2E$ ($)
	Transportation				
T-1	Pavley I Light-Duty Vehicle GHG Standards	27.7	1,372	11,381	-361
	Pavley II - Light-Duty Vehicle GHG Standards	4.0	594	1,643	-262
T-2	Low Carbon Fuel Standard	15	11,000	11,000	0
T-3	Local Government Actions and Targets (VMT Reduction)	5	500	2054	-311
T-4	Low Friction Oil	2.8	520	1,150	-225
	Tire Pressure Program	0.55	152	224	-131
	Tire Tread Program (Low resistance)	0.3	0.6	123	-408
	Solar Reflective Automotive Paint and Window Glazing	0.89	360	366	-6
T-5	Ship Electrification at Ports	0.20	0(1)	0(1)	0(1)
T-6	Goods Movement Efficiency Measures	3.5	TBD	TBD	0
T-7	Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)	6.4(2)	1,616(2)	2,137(2)	-81(2)
T-8	Medium and Heavy-duty Vehicle Hybridization	0.5	93	177	-169
T-9	High Speed Rail	1	0(1)	0(1)	0(1)
	Subtotal	***67.8***			
	Building and Appliance Energy Efficiency and Conservation				
E-1	Electricity Reduction Program 32,000 GWH reduced	15.2	3,402	5,065	-109
	Utility Energy Efficiency Programs				
	Building and Appliance Standards				
	Additional Efficiency and Conservation				
E-2	Increase Combined Heat and Power Use by 30,000 GWh	6.7	362	1,673	-190
CR-1	Natural Gas Reduction Programs (800 Million Therms saved)	4.3	963	1,433	-109
	Utility Energy Efficiency Programs				
	Building and Appliance Standards				
	Additional Efficiency and Conservation				
	Subtotal	***26.4***			

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Table G-I-2 (cont.): Costs, Savings, and Dollars Per Metric Ton of CO_2E Reduced
Recommended Greenhouse Gas Reduction Measures

	Measures	Reductions ($MMTCO_2E$ in 2020)	Costs ($Millions)	Savings ($Millions)	Net Cost or Savings Per $MTCO_2E$ ($)
	Renewable Energy				
E-3	RPS (33%)	21.3	3,672	1,889	133
E-4	California Solar Programs (3000 MW Installation)	2.1	0(1)	0(1)	0(1)
CR-2	Solar Water Heaters (AB 1470 goal)	0.14	0(1)	0(1)	0(1)
	High GWP Measures				
H-1	MVACS: Reduction of Refrigerant from Non-Professional Servicing	0.26	3	0	11.5
H-2	SF6 Limits in Non-Utility and Non-Semiconductor Applications	0.30	0.22	0.14	0.3
H-3	High GWP Reduction in Semiconductor Manufacturing	0.15	2.6	0	17
H-4	Limit High GWP Use in Consumer Products	0.25	0.06	0	0.2
H-5	High GWP Reductions from Mobile Sources	3.3	20.86	0	6.32
H-6	Specifications for Commercial and Industrial Refrigeration	4.0	1.24	0.66	0.1
	Foam Recovery and Destruction Program	0.30	9.0	0	30
	SF6 Leak Reduction and Recycling in Electrical Applications	0.10	0.3	0.4	-0.1
	Alternative Suppressants in Fire Protection Systems	0.10	1.96	0.2	18
	Gas Management for Stationary Sources--Tracking/Recovery/Deposit Programs	6.30	1.02	3.6	-0.4
	Residential Refrigeration Early Retirement Program	0.10	18.9	24.79	-58.9
H-7	Mitigation Fee on High GWP Gases	5	100	0	20

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Table G-I-2 (cont.): Costs, Savings, and Dollars Per Metric Ton of CO_2E Reduced
Recommended Greenhouse Gas Reduction Measures

	Measures	Reductions ($MMTCO_2E$ in 2020)	Costs ($Millions)	Savings ($Millions)	Net Cost or Savings Per $MTCO_2E$ ($)
	Industrial				
I-1	Energy Efficiency and Co-Benefits Audits	TBD	TBD	TBD	TBD
I-2	Oil and Gas Extraction GHG Emission Reduction	0.2	0.4	4	-18.5
I-3	GHG Leak Reduction from Oil and Gas Transmission	0.9	0.5	18	-19
I-4	Refinery Flare Recovery Process Improvements	0.33	6.7	46.1	-120
I-5	Removal of Methane Exemption from Existing Refinery Regulations	0.014	3.3	2.7	40.9
	Others				
RW-1	Landfill Methane Capture	1.0	52	0	52
A-1	Methane Capture at Large Dairies[3]	1.0	156	0	156
F-1	Sustainable Forest Target	5.0	50	0	10
W-1	Water Use Efficiency[4]	1.4	-	-	
W-2	Water Recycling[4]	0.3	-	-	
W-3	Pumping and Treatment Efficiency[4]	2.0	-	-	
W-4	Reuse Urban Runoff[4]	0.2	-	-	
W-5	Increase Renewable Energy Production[†]	0.9	-	-	
	Recommended Measures Totals	***140***	***$24,878***	***$40,417***	

Notes for Table I-2:

1 These measures are being pursued to achieve other policy goals, including renewable energy development and air quality/public health goals, so their costs and savings have not been attributed to implementation of AB 32.

2 The costs for this measure include the full equipment cost and savings to California firms realized nationwide. The California only GHG emissions reduction is 0.93 $MMTCO_2E$.

3 Because the emission reductions from this measure are not required, they are not counted in the total.

4 GHG reductions from the water sector may already be incorporated into the 2020 forecast. Therefore, they are not currently counted toward the 2020 goal. ARB will work with the appropriate agencies to determine whether these reductions are additional.

5 Subtotal is for Landfill Methane Capture and Sustainable Forest Target measures only.

Table G-I-3: Costs, Savings, and Dollars Per Metric Ton of CO_2E Reduced Measures Included in The Cap-and-Trade

Measures	Reduction ($MMTCO_2E$)	Costs ($Millions)	Savings ($Millions)	Net Cost or Savings Per $MTCO_2E$ ($)
Transportation				
Incentives to Reduce VMT[1]	*2*	*200*	*821*	*-310*
Electricity				
Energy Efficiency (8000 additional to 32,000 GWh Reduced Demand) [1]	*3.8*	*1,276*	*1,226*	*2.5*
Natural Gas				
Energy Efficiency (200 million Therms Reduced) [1]	*1.1*	*369*	*367*	*2.5*
Industrial				
Carbon Intensity Standard for Calif. Cement Manufacturers[1]	*1.9*	*19.4*	*22.8*	*-1.8*
Carbon Intensity Standard for Concrete Batch Plants[1]	*3.1*	*0*	*0*	*0*
Waste Reduction in Concrete Use[1]	*1.2*	*55*	*83*	*-23.5*
Refinery Energy Efficiency Process Improvement[1]	*3.4*	*64.5*	*415*	*-103*
Oil and Gas Extraction GHG Emission Reduction[1]	*1.8*	*107*	*274*	*-93*
GHG Leak Reduction from Oil and Gas Transmission[1]	*0.1*	*15*	*16*	*-15*
Industrial Boiler Efficiency[1]	*1.0*	*22.9*	*150*	*-127*
Stationary Internal Combustion Engine Electrification[1]	*0.3*	*17.9*	*25*	*-24*
Total	***19.7***	***$2,146***	***$3,070***	

Note for Table I-3:

1 Measures in italics are low-cost measures that were included in the economic modeling of the Proposed Recommendation, as discussed in Appendix G. They include the measures under evaluation in the Draft Scoping Plan with a cost per ton of reduction less than the carbon price produced by E-DRAM. They are intended as a proxy for the types of reductions that would be made under a cap-and-trade program.

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Climate Change Scoping Plan Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Appendix G: Economic Analysis
Appendix G-II
Environmental Dynamic Revenue Assessment Model's Sources And Methods

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Climate Change Scoping Plan Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Appendix G: Economic Analysis
Appendix G-II
Environmental Dynamic Revenue Assessment Model's Sources and Methods

1. INTRODUCTION

This Appendix describes the economic analysis and modeling results of the measures set out in the Recommendation of the Scoping Plan. The description of the results is followed by documentation for the Environmental Dynamic Revenue Analysis Model (E-DRAM), the model used for the economic assessment.

Macroeconomic models such as E-DRAM are well suited for analyzing the economy-wide impact of a set of recommended policy measures that either impose costs, provide savings, or both, taking into account their interaction and the shifting of economic activity across sectors. E-DRAM has been used in this fashion for a variety of past economic assessments.

Such models, however, face several challenges in attempting to model market-based policies that provide incentives to discover the least cost options for reducing emission including investments in improving technology. First of all, the macroeconomic tools do not have the ability to predict how firms might invest in cost-effective energy efficient technologies that will result in reduced greenhouse gas emissions and reduced energy-related expenditures. In E-DRAM, such cost-saving investments can only be reflected if they are specified in advance as exogenous inputs to the model, rather than the model endogenously determining the type and level of investment. This can be done for specific measures for which the costs and savings have been estimated. It can also be estimated for some portion of the reductions required from a cap-and-trade program where there is knowledge that sources under the cap have the ability to reduce emissions from well-defined, relatively low-cost investments in their own facilities that end up costing less than purchasing the reductions from the market.

An important characteristic of a market-based approach is the ability to reveal low-cost emission reduction opportunities as a result of market incentives. Because of the broad flexibility allowed by cap and trade, available models do not have a mechanism to properly determine the nature or costs of such "unspecified reductions" needed to meet the cap. By their very nature such reductions cannot be attributed in advance to any specific measures or even source type. To produce additional unspecified reductions the models simulate such reduction by reducing economic output. This type of model is unable to account for the possibility of new investment in some sectors that could increase their energy efficiency and reduce emissions either at a net savings or lower cost than reducing demand through price increases. Instead, these models adjust prices of products so that they reflect the cost of GHG emissions (based upon calculated allowance prices), resulting in reductions in sector production and resulting sector emissions until the required emissions reductions are

achieved. Consequently, emission reductions in the model occur in response to reduced demand induced by increased prices. For this reason, these models provide an inaccurate and overly costly picture of how a cap-and-trade system would operate in practice.

In addition, the macroeconomic models operate at the sector level and therefore do not have the ability to capture the heterogeneity of facility-level emission reduction opportunities. One of the primary advantages of market-based approaches is that they take advantage of this heterogeneity to minimize costs. Such savings have been documented by empirical studies. As was noted by the Market Advisory Committee, "This potential for cost savings is not simply a theoretical proposition. Studies indicate substantial cost savings from existing cap-and-trade programs. The two major studies of cost savings for the SO_2 program[30] are in general agreement that savings under the trading program amounted to 43–55 percent of expected compliance costs under an alternative regulatory program that imposed a uniform emission standard. Carlson et al. cite savings of over 65 percent compared to a policy that might have forced post-combustion controls (scrubbers) to achieve the same level of emissions."[31]

The marginal cost of achieving reductions varies significantly among facilities, firms, and regions depending on a host of site, firm, or location-specific factors. Market-based approaches enable the reductions to come from those facilities that can achieve them at lower cost than the market price. However, the models treat all facilities within a sector as similar and therefore cannot account for cost structure differences and as such cannot capture cost reduction opportunities.

Moreover, the models do not fully capture how individual consumers can and will take steps to pursue lower cost options. This is being observed today as consumers change driving habits and make greater use of public transit, carpooling and biking in response to gasoline price increases. In addition, over time market-based approaches provide an incentive to find innovative ways to reduce emissions beyond the level necessitated at an individual firm under a performance standard. Again, available models do not capture how such innovation can reduce cost.

Our E-DRAM modeling of the Recommendation attempted to remedy these limitations by searching for measures that are likely to meet the market test of being lower than the carbon price established by the market participants. That is, we have approximated the operation of the cap-and-trade program as well as available modeling tools allow. To capture how facilities might make technology changes to reduce emissions, the costs and savings of known efficiency measures were identified so that the cost per ton for reductions from those measures could be compared to allowance prices under a cap-and-trade system. It is then assumed that facilities will choose to implement measures that cost less than the anticipated

[30] Carlson, C., Burtraw, D., Cropper, M. & Palmer K.L. (2000). Sulfur Dioxide Control by Electric Utilities: What are the Gains from Trade? The Journal of Political Economy, 108(6), 1292-1326. ; Ellerman, A. D. (2003). Lessons rom Phase 2 Compliance with the U.S. Acid Rain Program. Working Paper 03-009. Cambridge: MA: Massachusetts Institute of Technology Center for Energy and Environmental Policy Research.
[31] Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California, Recommendations of the Market Advisory Committee to the California Air Resources Board, June 30, 2007 p. 7

allowance price to the extent they have been identified. This follows the market rule of selecting low cost options. Therefore, the analysis of the Recommendation includes measures that cost less per ton of GHG emissions reduced than the simulated cap-and-trade market price of carbon. These measures had a net cost that falls below the market price as solved by the model through an iterative process were used as inputs (i.e., because they represent a lower cost path than the market price the measures would be expected to occur).

This approach provides a conservative approximation of how a portion of the reductions will be achieved by industry. This technique partially addresses the model's lack of an internal mechanism to identify efficiency measures, but does not eliminate it. It does not allow for innovation, nor does it address the limitations noted above regarding cost minimization decisions made at the facility level.

Keeping these limitations in mind, our estimate of the economic impact of the Recommendation will understate the benefits of market-based approaches including the cap-and-trade program and therefore will understate the positive impact of the Recommendation on the California economy. We nevertheless believe that the estimate provides useful information and is a reasonable application of the model.

2. MODELING RESULTS

E-DRAM was used to analyze the Recommendation from the Scoping Plan. The input assumptions for this analysis included cost and savings information for specified measures from the Scoping Plan that result in emission reductions of approximately 160 million metric tons of CO_2E ($MMTCO_2E$). These reductions include 140 $MMTCO_2E$ from the specified measures in the Recommendation, plus an additional 20 $MMTCO_2E$ that result from low cost measures expected to be pursued under a cap-and-trade program that were included among the other measures under evaluation in the Scoping Plan. The remaining 14 million tons needed to achieve the 174 $MMTCO_2E$ of emission reductions included in the Recommendation are achieved through the simulation of the cap-and-trade program as described below.

The analysis used the greenhouse gas emission reduction measures presented in the Scoping Plan to characterize the costs, savings and emission reductions. More detailed descriptions of the measures were included in Appendix C to the Scoping Plan. Additional information on the cost and savings estimates used in this modeling effort is presented in Appendix G-I, and additional information on the calculation of the costs and savings used in the economic analysis is presented in Appendix I.

The cap-and-trade component of the Recommendation is simulated by increasing the price of electricity, natural gas, and transportation fuels to reflect the carbon content of those fuels. As discussed earlier, this provides a conservative estimate of the benefits of a cap-and-trade approach. All allowance or fee revenues remain in the state and are allocated back to consumers. Per the previous discussion, this approach was used to identify the carbon price necessary to result in reduction of 14 $MMTCO_2E$ in 2020. The subsequent section provides further detail on the approach that was used to model the Recommendation.

No additional cost minimizing methods, such as offsets, emission allowance banking or borrowing, are included in the analysis.

2.1 Business-as-usual Base Case

The economic impacts of the Scoping Plan are expressed as changes from a business-as-usual estimate of California's economic growth. As noted, the business-as-usual (BAU) case assumes that none of the measures included in the Scoping Plan are implemented. As Table G-II-1 below indicates, for the BAU case, Gross State Product is projected to grow by about 2.8 percent annually to a value of nearly $2.6 trillion by 2020. Personal income is projected to grow by approximately 2.8 percent annually and job growth is also expected to continue as we move toward 2020.

Table G-II-1: Business-as-usual Case for California Economy

Economic Indicator	2007	2020	Change	Average Annual Growth (%)
Real Output ($Billions)	2,535	3,597	1,062	2.7%
Gross State Product ($Billions)	1,811	2,586	775	2.8%
California Personal Income ($Billions)	1,464	2,093	628	2.8%
Income Per Capita ($1000)	38.6	47.6	9	1.6%
Employment (Millions)	16.41	18.41	2	0.9%
Emissions ($MMTCO_2E$)	500[1]	596	96	1.4%[1]

[1] Approximate value. The ARB is in process of estimating the GHG emissions for 2007.

2.2 Macro-Economic Effects of the Recommendation

Table G-II-2 shows how implementation of the Recommendation would impact California's economy relative to a business-as-usual growth trajectory between now and 2020. The effects on output, personal income and employment are small but positive. Total output, which represents production activity in the state, increases by 0.9 percent over BAU. This translates into an increase of approximately $33 billion in 2020, which is a relatively minor increase when evaluated in the context of a $3.6 trillion economy. Also represented in Table II-2 are the impacts of the Recommendation on Gross State Product, personal income, income per capita, and employment. In each case, the modeling shows a small but positive impact.

Table G-II-2: Economic Impacts of the Scoping Plan Recommendation

Economic Indicator	BAU Case	Recommendation	Change from BAU	Percent Change from BAU
Real Output ($Billions)	3,597	3,630	33	0.9%
Gross State Product ($Billions)	2,586	2,593	7	0.3%
Personal Income ($Billions)	2,093	2,109	16	0.8%
Income Per Capita ($1000)	47.56	47.76	0.21	0.4%
Employment (Millions)	18.41	18.53	0.12	0.7%
Emissions ($MMTCO_2E$)	596	421	175	-29%
Carbon Price (Dollars)	NA	10.00	NA	NA

The positive impacts are largely attributable to savings that result from reductions in expenditures on energy. These savings translate into increased consumer spending on goods and services other than energy. Many of the measures entail more efficient use of energy in the economy, with savings that exceed their costs. All told, the specified reduction measures in the Scoping Plan's Recommendation (not including additional unspecified reductions from cap-and-trade) are expected to reduce emissions of approximately 160 $MMTCO_2E$ in 2020 at a net savings of about $15.4 billion, which provides a positive stimulus to the economy.

When modeling the Recommendation, the model should reflect the fact that facilities will pursue emission reduction options that have a cost per ton that is lower than the market price. In the absence of complete information on what those options might be, we included in the model runs the technical options that have been identified as part of the additional measures that cost less than the market allowance price. This is an incomplete list, and the model does not have the capability to adequately reflect the full set of options that are available to covered sectors under cap and trade. Thus, this approach provides a rough approximation of how a portion of the reductions from the market approach would be achieved. This approach resulted in measures that provided an additional 20 $MMTCO_2E$ in reductions being included in the model run of the Recommendation, with only the final 14 $MMTCO_2E$ of reductions achieved by pricing mechanisms within the model itself that moderated consumer demand. Appendix G-I provides a complete list of the measures included in this modeling run.

The modeling results presented for the cap-and-trade component of the Recommendation reflect a carbon price of $10 per ton of $MTCO_2E$. It is important to note that the $10 per ton figure does not reflect the cost of the program; rather it is the maximum price at which reductions to achieve the cap is pursued. We will continue to evaluate these results and anticipate that modeling efforts currently underway in the Western Climate Initiative will also provide useful additional information. We also encourage any interested stakeholders to conduct their own analyses and share their results.

As discussed in the Scoping Plan, a properly designed offset program can play a valuable role within a cap-and-trade program. Offsets offer the opportunity to achieve reductions from sectors outside of the cap, often at costs lower than reductions from within the cap. This can be a key driver in moderating allowance prices, particularly in the early years of a program. Offsets also provide incentives for entities to develop and implement innovative strategies to reduce emissions outside of the capped sectors, which can have additional economic and environmental benefits.

As previously discussed, the estimated allowance price for a cap-and-trade program was $10 per ton. As such, when we ran the E-DRAM with offsets only assumed to be available at $20 per ton, there was no demand. Nevertheless, we believe that a limited availability of high quality offsets is advisable in light of the uncertainty associated with program implementation. As we work on further analysis related to the allowance price in a cap-and-trade program design, we will continue to evaluate the economic impact of offsets as well.

2.3 Sector-Level Effects of the Recommendation

The E-DRAM provides a detailed picture of the California economy that includes 120 distinct industrial sectors. For the industrial sectoring, a grouping of firms all of which make similar, though by no means identical, products is referred to as a sector. The model's input dataset is an explicit representation of the inter-sector flows of value within the California economy in 2003. The sectoral linkages established in this dataset determine how policy effects are transmitted through the economy. Sectors are affected directly by a specific policy and indirectly through sector linkages.

A model such as E-DRAM is most useful for characterizing economic impacts at the state level. It can also be informative at the sector level with the understanding that some sectoral details that may be important in characterizing how producers will respond to a policy change may not be fully reflected in the model. For example, the industrial sectors, as represented in the model, produce a single good utilizing the same production technology that is sold at a single price. Issues that may be particularly important to individual sectors will likely have to be more thoroughly assessed using other methods as individual regulations targeting the sector are developed.

With an individual measure, understanding which sectors are affected and why is straightforward. However, given the number of measures in the Recommendation presented in the Scoping Plan, breaking out exactly how and why a specific sector is affected can be challenging. Many of the individual measures affect prices in opposite directions. For example, an efficiency measure causes less energy to be purchased, which would have the effect of reducing the price of energy. A carbon price would do the opposite by raising the price of energy. However, when the measures are run together, as is the case for the analysis presented in this supplement, the effect on energy prices of an efficiency measure and a cap-and-trade measure would depend on which measure produces the stronger effect.

Finally, with 120 industrial sectors, the volume of information produced can make interpretation of results difficult. Results are therefore aggregated by industry type corresponding to the 2-digit North American Industry Classification System (NAICS). Aggregation of related sectors is a useful approach for gaining insights into the "big picture" impacts of the policies. Further detail for each of the aggregated sectors is discussed in the remainder of this document.

Tables G-II-3 and G-II-4 present the change in Average Weighted Prices, Real Output and Employment for the sector aggregations for the Recommendation. The values reported in the tables for Real Output and Employment are simply summations of Output and Employment for the individual sectors. Price changes are weighted based on the individual sectors' share of output in the aggregate sector so that the price change is reflective of the price change that occurs in the larger sectors.

All changes are discussed in relation to the business-as-usual case, so when it is stated that a sectors grows, it means that it grows in excess of the BAU growth.[32] A brief discussion of aggregated sectors within the model follows.

[32] All individual sectors grow in the business-as-usual case with the exception of the Petroleum and Natural Gas Extraction sector, which declines by assumption.

Table G-II-3: E-DRAM 2020 Business-as-usual Prices, Output and Employment

Sector	Prices*	Output (Billions 2007 $)	Employment (Thousands)
Agriculture, Forestry and Fishing	1.0	109	449
Mining	1.0	29	26
Utilities	1.0	72	67
Construction	1.0	164	929
Manufacturing	1.0	943	2,046
Wholesale Trade	1.0	171	791
Retail Trade	1.0	296	1,901
Transportation and Warehousing	1.0	109	503
Information	1.0	235	448
Finance, Insurance and Real Estate	1.0	559	1,026
Services	1.0	910	6,729
Government	-	-	3,491
Total	**-**	**3,597**	**18,405**

* All prices are normalized to 1.0 in the Business as Usual case.

Table II-4: E-DRAM 2020 Estimates the Changes in Prices, Output and employment for the Recommendation

Sector	Prices	Output (Billions 2007$)	Employment (Thousands)
Agriculture, Forestry and Fishing	1.0	113	464
Mining	1.0	31	26
Utilities	1.1	60	57
Construction	1.0	166	934
Manufacturing	1.0	948	2,057
Wholesale Trade	1.0	173	793
Retail Trade	1.0	291	1,916
Transportation and Warehousing	1.0	111	510
Information	1.0	238	450
Finance, Insurance and Real Estate	1.0	572	1,046
Services	1.0	927	6,773
Government	-	-	3,502
Total	**-**	**3,630**	**18,528**
	Percent change from BAU		
Agriculture, Forestry and Fishing	0.0	3.9	3.5
Mining	0.9	7.2	1.3
Utilities	8.8	-16.7	-14.7
Construction	0.1	1.7	0.5
Manufacturing	0.2	0.5	0.5
Wholesale Trade	-0.6	1.0	0.1
Retail Trade	-0.3	-1.6	0.8
Transportation and Warehousing	-0.5	1.9	1.2
Information	-0.3	1.1	0.4
Finance, Insurance and Real Estate	-0.2	2.3	2.0
Services	-0.4	1.9	0.7
Government	-	-	0.3
Total	**-**	**0.9**	**0.7**

2.3.1 Agriculture, Forestry and Fishing (NAICS Code 11)

The Agriculture, Forestry and Fishing sector comprises establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural habitats. The Agriculture, Forestry and Fishing sector is comprised of four individual E-DRAM sectors.

Overall, prices in the Agriculture, Forestry and Fishing sector remain unchanged from the BAU case. Output and employment both increase by more than 3 percent from the BAU case. Much of the overall sector growth can be attributed to increased producer energy efficiency and an increase in the demand for agricultural output as

feedstock for the production of ethanol. Output and employment in all of the individual sectors in this grouping grow.

2.3.2 Mining (NAICS Code 21)

The Mining, Quarrying, and Oil and Gas Extraction sector comprises establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. The term mining is used in the broad sense to include quarrying, well operations, beneficiating (e.g., crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity. The Mining sector is comprised of two individual E-DRAM sectors.

Overall, prices in the Mining sector decrease slightly, while output increases by 7.2 percent and employment increases by 1.3 percent. The Petroleum and Natural Gas Extraction sector accounts for all of the growth in the Mining sector. The reason for the increased growth in the Petroleum and Natural Gas Extraction sector is directly related to the Oil and Gas Extraction Emission Reduction measure that is estimated to provide savings that greatly exceed the costs of implementation (i.e., net savings of about $56 million). Output and employment decreases in the other mining sector primarily because of the increased price of electricity.

2.3.3 Utilities (NAICS Code 22)

The Utilities sector comprises establishments engaged in the provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the utility services provided vary by utility: electric power includes generation, transmission, and distribution; natural gas includes distribution; steam supply includes provision and/or distribution; water supply includes treatment and distribution; and sewage removal includes collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities. The Utilities sector is comprised of three individual E-DRAM sectors.

Prices in the Utilities sector increase, with the price of electricity increasing by 11 percent and the price of natural gas increasing by almost 9 percent. Output and employment in the Utilities sector decrease by 16.7 percent and 14.7 percent respectively. The negative output and employment effects in the Utilities sector result from consumers purchasing less electric power and natural gas because of implementing the energy efficiency measures and because of higher prices. Decreases in the demand for electricity and natural gas translates into decreases in employment for the Electrical Power Generation and Distribution (-32 percent) and Natural Gas Distribution sectors (-7 percent). Most utility sector jobs are linked to the delivery of power and maintaining the system and not in the actual running of power plants. In addition, many jobs resulting from increased investment in renewable resources and energy efficiency will appear in other sectors, such as construction. So it is likely that the number of jobs in this sector will remain relatively unchanged even though the model estimates a decreased number of jobs.

However, it should be noted that the Utility sector is relatively small in terms of overall employment.

2.3.4 Construction (NAICS Code 23)

The construction sector comprises establishments primarily engaged in the construction of buildings or engineering projects (e.g., highways and utility systems). Establishments primarily engaged in the preparation of sites for new construction and establishments primarily engaged in subdividing land for sale as building sites also are included in this sector. The Construction sector is comprised of five individual E-DRAM sectors.

Prices in the Construction sector remain virtually unchanged, increasing by 0.1 percent. Output and employment in the Construction sector increase slightly: 1.7 percent for output and 0.5 percent for employment. Increases in output for the Residential, Nonresidential and Other Construction sectors, however, offsets reductions in Street and Bridge (-0.3 percent) and Utility Infrastructure Construction (-11 percent). The growth in output is potentially the result of the residential and commercial building efficiency strategies increasing the demand for new and retrofit construction. Reduced demand for electricity and natural gas reduces the need for new Utility Infrastructure construction which translates into less employment for this sector (-12 percent).

2.3.5 Manufacturing (NAICS Codes 31-33)

The Manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. The Manufacturing sector is comprised of 42 individual E-DRAM sectors.

Prices in the Manufacturing sector increase by 0.2 percent. Output and employment in the Manufacturing sector increase slightly: 0.5 percent for both output and employment. Most of the individual sectors grow with the exception of Oil Refineries, Apparel Manufacturing, Automobile Manufacturing and Other Vehicle Manufacturing. The negative effect on Oil Refineries (-27 percent) is a direct response to the transportation and fuel policies that explicitly state that less transportation fuel will be purchased in California. However, we believe that virtually all of the change in output in the refinery sector will be the result of reduced imports of refined gasoline and not the result of reduced in-state production. Therefore, it is unlikely that the projected number of jobs would be reduced significantly from the business-as-usual case. Additionally, it should be noted that the Refining sector is relatively small in terms of overall state employment.

The effects on the remaining sectors are less straightforward. The Apparel Manufacturing, Automobile Manufacturing and Other Vehicle Manufacturing sectors are all sectors where a large share of the California demand is met by imported products. Any increase in the California price will further increase the demand for imported products at the expense of California production. In the Apparel sector,

demand for apparel increases as expenditures shift away from energy to other goods. The increased demand for apparel increases the California price relative to the import price which causes output to decrease by 15 percent and employment to decrease from 16 percent.

A similar pattern is exhibited in the Automobile Manufacturing and Other Vehicle Manufacturing sectors. Increases in the price of vehicles that result from the motor vehicle measures increases the demand for imported vehicles at the expense of domestically produced vehicles which causes output and employment to decrease. In the Automobile Manufacturing sector output decreases by 2.5 percent and employment decreases by 3.4 percent, while in the Other Vehicle Manufacturing sector output decrease by 4.6 percent and employment decreases by 6 percent.

2.3.6 Wholesale Trade (NAICS Codes 42)

The Wholesale Trade sector comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing. The wholesaling process is an intermediate step in the distribution of merchandise. The Wholesale Trade sector is comprised of five individual E-DRAM sectors.

Prices in the Wholesale Trade sector decrease by 0.6 percent. Output increases slightly (1.0 percent) while employment is unchanged. Sector growth can likely be attributed to increased energy efficiency within the sector and to increased consumer spending brought on by shifting expenditures away from energy to other goods and services.

2.3.7 Retail Trade (NAICS Codes 44-45)

The Retail Trade sector comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public. The Retail Trade sector is comprised of 12 individual E--DRAM sectors.

Prices in the Retail Trade sector decrease by 0.3 percent. Output decreases by 1.6 percent, while employment increases by 0.8 percent. However, most of the individual sectors grow with the exception of the Retail Gasoline sector. The large negative effect on the Retail Gasoline sector (-18 percent) is the result of reduced purchases of transportation fuel that occur because of the transportation and fuel measures.

Growth in the other sectors can likely be attributed increased energy efficiency within the sector and to increased consumer spending brought on by shifting expenditures away from energy to other goods and services.

2.3.8 Transportation and Warehousing (NAICS Codes 48-49)

The Transportation and Warehousing sector includes industries providing transportation of passengers and cargo, warehousing and storage for goods, scenic and sightseeing transportation, and support activities related to modes of transportation. Establishments in these industries use transportation equipment or transportation related facilities as a productive asset. The type of equipment depends on the mode of transportation. The modes of transportation are air, rail, water, road, and pipeline. The Transportation and Warehousing sector is comprised of eight individual E-DRAM sectors.

Prices in the Transportation and Warehousing sector decrease slightly (0.5 percent). Output and employment increase by 1.9 and 1.2 percent respectively. No individual sectors are adversely affected. Sector growth can be attributed to increased vehicle efficiency which reduces the price of providing transportation related services and the decreased price of transportation fuels.

2.3.9 Information (NAICS Code 51)

The Information sector comprises establishments engaged in the following processes: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data. The Information sector is the aggregation of four individual E-DRAM sectors.

Prices in the Information sector decrease by 0.3 percent. Output (1.1 percent) and employment (0.4 percent) both increase. No individual sectors are adversely affected. Sector growth can likely be attributed to increased energy efficiency within the sector and to increased consumer spending brought on by shifting expenditures away from energy to other goods and services.

2.3.10 Finance, Insurance and Real Estate (NAICS Codes 52-53)

The Finance and Insurance sector comprises establishments primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in ownership of financial assets) and/or in facilitating financial transactions. The Real Estate and Rental and Leasing sector comprises establishments primarily engaged in renting, leasing, or otherwise allowing the use of tangible or intangible assets, and establishments providing related services. The Finance, Insurance and Real Estate sector is comprised of five individual E-DRAM sectors.

Prices in the Finance, Insurance and Real Estate sector decrease by 0.2 percent. Output and employment increase by 2.3 percent and 2.0 percent respectively. No individual sectors are adversely affected. Sector growth can likely be attributed to increased energy efficiency within the sector and to increased consumer spending brought on by shifting expenditures away from energy to other goods and services.

2.3.11 Services (NAICS Codes 54-81)

The service sector comprises establishments primarily engaged in the provision of services to their customers. These include Professional, Scientific, and Technical Services, Management Services, Administrative Services, Educational Services, Health Services, Arts, Entertainment, and Recreation, Accommodation and Food Services and Other Services. All service sectors are aggregated in a single sector. The Service sector is comprised of 29 individual E-DRAM sectors.

Prices in the Service sector decrease by 0.4 percent. Output (1.9 percent) and employment (0.7 percent) both increase. Most individual sectors respond positively to the Scoping Plan measures except for Amusement Parks and Hospitals. The reason for the negative result in these two sectors is potentially the response to higher electricity prices since purchases from the Electrical Power Generation and Distribution make up a large share of these sectors' operating expenses. Growth in the other sectors can likely be attributed increased energy efficiency within the sector and to increased consumer spending brought on by shifting expenditures away from energy to other goods and services.

3. OVERVIEW OF THE ENVIRONMENTAL-DYNAMIC REVENUE ANALYSIS MODEL

Computable General Equilibrium (CGE)[33] models represent explicitly the utility and profit maximizing behavior of households and firms and estimate how policy impacts affect agents both directly and indirectly. The models are "computable" because numeric solutions are found using computers rather than solved for algebraically. They are "general" in the sense that all markets and all income flows in the economy are accounted for. They reflect "equilibrium" insofar as prices adjust to equilibrate the demand for and supply of goods, services, and factors of production (labor and capital) of the model.

The specific model described here is a modified version of the Environmental-Dynamic Revenue Analysis Model (E-DRAM). The E-DRAM was built for the California Air Resources Board (ARB) by researchers at the University of California at Berkeley. The E-DRAM evolved from the Dynamic Revenue Analysis Model (DRAM), which was developed jointly by the California Department of Finance (DOF) and Berkeley researchers to perform dynamic revenue analyses of proposed legislation as mandated by Senate Bill 1837 in 1994. Much of the description of E-DRAM is closely adapted from Berck, Golan, and Smith (1996), which, henceforth, will be referred to as the DRAM Report.[34] The model has been updated to a 2003 base year.

The remainder of this Appendix is a non-technical description of E-DRAM.

3.1 Description of E-DRAM

The E-DRAM describes the relationship among California producers, California households, California governments, and the rest of the world. Rather than tracking each individual producer, household, or government agency in the economy, however, E-DRAM combines similar agents into single sectors. Constructing a sectoring scheme, the first step of model construction, is discussed immediately below; this discussion is followed by a description of the key agents in the economy—producers and consumers.

3.1.1 Aggregation and Data Sources

The E-DRAM, like all other empirical economic models, treats aggregates rather than individual agents. Aggregation is done both to provide focus for the analysis and constrain the number of variables in the model. Constructing an aggregation (or sectoring) scheme is critical in the development of a CGE model because it determines the flows that the model will be able to trace explicitly. For the E-DRAM model, the California economy has been divided into 186 distinct sectors: 120 industrial sectors, 2 factor sectors (labor and capital), 9 consumer good sectors, 8 household sectors, 1 investment sector, 45 government sectors, and 1 sector

[33] For E-DRAM's sources and methods discussed in this Appendix, an unpublished paper by Professor Peter Berck is liberally quoted.
[34] The DRAM Report is available at www.dof.ca.gov/HTML/FS_DATA/dyna-rev/dynrev.htm.

representing the rest of the world. The complete details of the sectoring are given in Chapter II of the DRAM Report.

For industrial sectoring purposes, all California firms making similar products are aggregated together. The agriculture sector, for example, contains all California firms producing agricultural products. The output value of that sector is the value of all output produced by California agricultural producers. A sector's labor demand is the sum of labor used by all firms in the sector. Along with agriculture, there are 119 other producer aggregates in the model. These aggregates generally represent the major industrial and commercial sectors of the California economy, though a few are tailored to capture sectors of particular regulatory interest. For instance, production of internal-combustion engines and consumer chemicals are each delineated as distinct sectors, as requested by ARB.[35]

Data for the industrial sectors originate from the U.S. Department of Commerce's Bureau of Economic Analysis and are based on the Census of Business—a detailed survey of U.S. companies conducted every five years. The survey contains information about intermediate purchases, factor (labor, capital, land, and entrepreneurship) payments, and taxes. Although quite extensive, the survey only allows inference about groups of firms at the national level. The disaggregation of national data to a California level is accomplished using a combination of state-level employment data and estimates from California Department of Finance.

Like firms, households are also aggregated. California households are divided into categories based upon their income. The model includes eight such categories, each one corresponding to a California Personal-income Tax marginal tax rate (0, 1, 2, 4, 6, 8, 9.3, and a high-income 9.3 percent). Thus, the income from all households in the 1 percent bracket is added together and becomes the income for the "1 percent" household sector. Similarly, all expenditure on agricultural goods by the 1 percent households is added and becomes the expenditure of the 1 percent household sector on agricultural goods. Total household expenditure on agricultural goods is the sum of expenditures by all eight household sectors. Household income data come from the California Franchise Tax Board Personal-income Tax "sanitized" sample. Data on consumption by income class are derived from national survey data.

The government sectors in E-DRAM are organized so that both government revenue flows and expenditure flows are traced explicitly. The E-DRAM includes 45 government sectors: 7 federal, 27 state, and 11 local. Government sector data are culled from published federal, state, and local government reports.

[35] The alcohol, tobacco, and horse-racing sector, distinct in DRAM, has been folded into the foods sector in the latest version of E-DRAM.

3.1.2 Producers and Households

Fundamental to the California economy and, hence, E-DRAM, are the relationships between the two principal types of economic agents—producers and households.

Producers are aggregated into industrial sectors. For example, the output of all of California's agricultural firms is modeled as coming from a single entity—the agriculture sector. Each sector takes the price that it receives for its output and the prices that it pays for its inputs (capital and labor, called "factors of production," and other inputs, called "intermediate goods") as given. The model assumes perfect competition which means that producer purchase decisions have no effect on input prices. Each producer is assumed to choose inputs and output to maximize profits. Inputs are labor, capital, and intermediate goods (outputs of other firms). Thus, the producer's supply of output is a function of its product price and the prices of inputs. More information on producers is provided in Chapter IV of the DRAM Report.

Households make two types of decisions: they buy goods and services and they sell labor and capital. Households are assumed to make these decisions in the way that maximizes their well-being (called "utility" in the economics literature). Like firms, consumer purchases have no effect on product prices. In addition to their labor income, households receive dividends and interest from their stocks and bonds and other ownership interests in capital.

Households' supply of labor, as a function of the wage rate, is called the "labor-supply function." A more detailed description of the supply of labor is given in Chapter VII of the DRAM Report.

Households' demand for goods or services, as a function of prices, is simply called the "demand function." A more detailed description of the demand for goods and services is given in Chapter III of the DRAM Report as well as in Berck, Hess, and Smith, 1997. The latter report explains how the distribution of household spending across the 120 industrial sectors via the nine consumer goods sectors is based on analysis of U.S. Bureau of Labor Statistics' Consumer Expenditure Survey data.

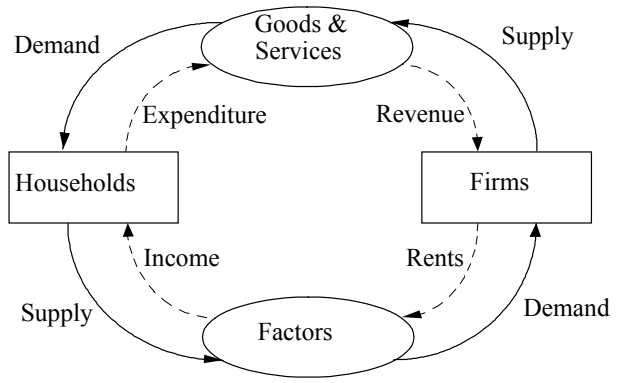
3.1.3 Equilibrium

So far, two types of agents have been described: firms and households. It remains to be explained how these agents relate. Agents relate through two types of markets: factor markets and goods-and-services markets. Firms sell goods and services to households in the goods-and-services markets. Households sell labor and capital services to firms in the factor markets. There is a price in each of these markets. There is a price for the output of each of the 120 industrial sectors. There is a price for labor, called the "wage," and a price for capital, called the "rental rate." Equilibrium in the market means that the quantity supplied is equal to the quantity demanded. Equilibrium in the factor markets for labor and capital and in the markets for goods and services defines a simple general equilibrium. That is, there are 122 prices (the wage, the rental rate, and one for each of the 120 goods made by the 120 sectors) and these 122 prices have the property that they equate quantities supplied and demanded in all 122 markets.

These relationships are shown in more detail in Figure II-1, called a "circular-flow diagram." The outer set of flows, shown as solid lines, are the flows of "real" items, goods, services, labor, and capital. The inner flows, shown as broken lines, are monetary flows. Thus, firms supply goods and services to the goods-and-services market in return for revenues that they receive from the goods-and-services markets. Firms demand capital and labor from the factor markets and in return pay wages and rents to the factor markets.

Households, the other type of agent in a simple model, buy goods and services from the goods-and-services markets. Households sell capital and labor on the factor markets and receive income in exchange.

Figure II-1: The Basic Circular-Flow Diagram



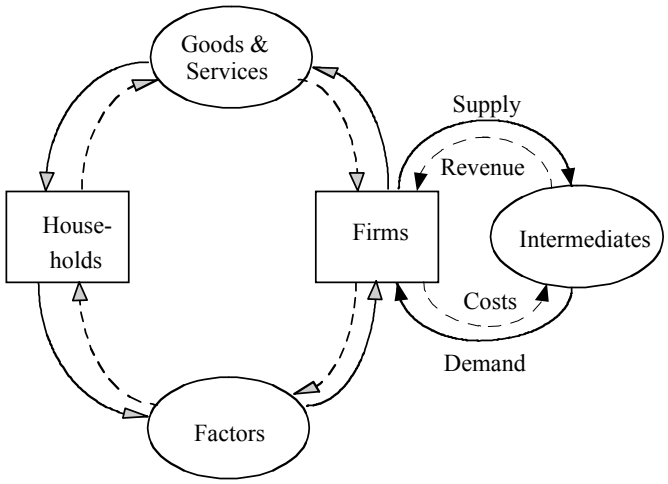
Source: Berck, Golan, and Smith, 1996.

3.1.4 Intermediate Goods

The economy of California is far more complex than that shown in Figure II-1. There are not only final goods-and-services markets but also intermediate-goods markets in

which firms sell to firms. A typical example of a market for intermediate goods would be fertilizer sold to agricultural firms. A final output of the chemical industry is fertilizer, which is an intermediate good in the agricultural industry. This type of market interaction is demonstrated in Figure II-2. Here, part of the output of a chemical firm (chemical industry in the example) is not sold to households but rather to another firm. The expense of buying the input is a cost of production. Chapter IV of the DRAM Report contains the model specification for these types of transactions, which are based upon a national input-output table.

Figure II-2: The Circular-Flow Diagram with Intermediate Goods

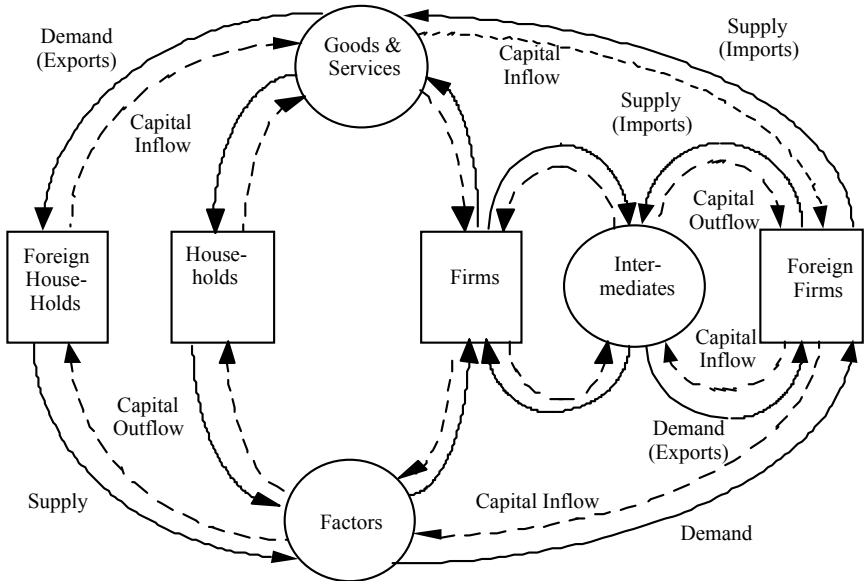


Source: Berck, Golan, and Smith, 1996.

3.1.5 Rest of the World

California is an open economy, which means that it trades goods, services, labor, and capital with neighboring states and countries. In this model, all agents outside California are modeled in one group called "Rest of World." No distinction is made between the rest of the United States and foreign countries. California interacts with two types of agents: foreign consumers and foreign producers. Taking the producers first, Figure II-3 shows that the producers sell goods on the (final) goods-and-services markets and on the intermediate markets, i.e., they sell goods to both households and firms. The model takes these goods as being imperfect substitutes for the goods made in California. Agricultural products from outside of California (e.g., feed grains, bananas) are taken as being close to, but not identical to, California-grown products (e.g., avocados, fresh chicken). The degree to which foreign and domestic goods substitute for each other is very important, and the evidence is described in Chapter V of the DRAM Report. Foreign households buy California goods and services on the goods-and-services markets. They and foreign firms both can supply capital and labor to the California economy, and domestic migration patterns are described in Chapter VIII.

Figure II-3: The Circular-Flow Diagram with Intermediate Goods and Trade

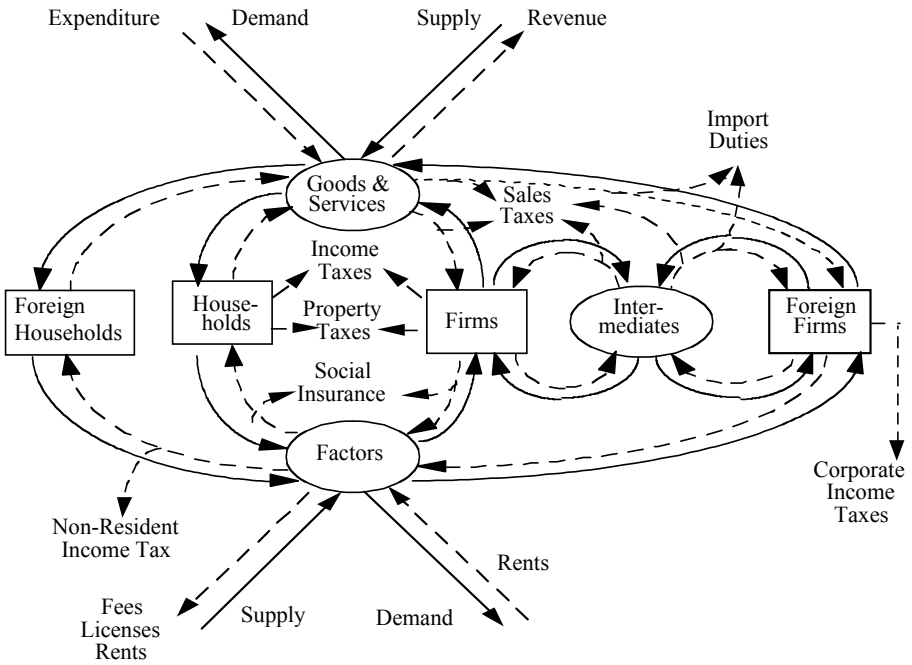


Source: Berck, Golan, and Smith, 1996.

3.1.6 Government

Finally, government is considered. Combining the taxing and spending effects of the three levels of government (federal, state, and local) gives the additional flows in Figure II-4. Beginning at the top, the figure shows that government buys goods and services and gives up expenditure. It supplies goods and services for which it may or may not receive revenue. Government also supplies factors of production, such as roads and education. Government also makes transfers to households, which are not shown in the diagram. The middle section of the diagram shows the myriad of ways in which government raises revenue through taxation. Chapter II of the DRAM Report includes a detailed description of the government activities in the model.

Figure II-4: The Complete Circular-Flow Diagram



Source: Berck, Golan, and Smith, 1996.

3.1.7 Data Organization: The Social Accounting Matrix

The first step in constructing a CGE model is to organize the data. The traditional approach to data organization for a CGE model is to construct a Social Accounting Matrix (SAM). A SAM is a square matrix consisting of a row and column for each sector of the economy. Each entry in the matrix identifies an exchange of goods and services purchased by one sector from another sector (or itself). The entries along a row in the SAM show each payment received by that particular row sector from each column sector. Summing across the row gives total payments made to that row sector by all column sectors. The entries down a column in the SAM show the expenditures made by that particular column sector to all row sectors. Summing down a column

gives total expenditures by that column sector to all row sectors. For accounting purposes, a SAM must "balance," i.e., each row sum and corresponding column sum must be equal. This balancing ensures that no money "leaks" out of the economy, i.e., that all money received by firms (row sum) is spent by them (column sum).

3.1.8 Other Considerations and Model Building

Computable General Equilibrium models are not forecasting models; they are calibrated to reproduce a base year. In the case of E-DRAM, the model is constructed to exactly reproduce the economic conditions of calendar year 2003. Of course, there are forecasting models. However, such models typically do not have the level of detail needed to examine dynamic policy effects. Given the paucity of California-specific data, it seems a better compromise to use a forecasting model, such as the one maintained by DOF, to set a base case and then use a policy model, such as DRAM, to analyze deviations from that case.

The E-DRAM model incorporates two assumptions that require some comment. It assumes competitive behavior in all private sectors. This is a good first approximation, particularly at the level of a sector. The alternative, market power, may well be present, but the degree of non-competitive pricing is not likely to be significant in aggregated sectors. The second assumption is that involuntary unemployment is constant. This assumption is unlikely to be strictly true. The model has voluntary unemployment, which are agents deciding to work less when the wage is lower. This assumption is common to all equilibrium models. Technical issues of model closure are described in Chapter IX of the DRAM Report.

Once the major agents in the economy have been identified and the relationship between these agents has been specified, the model can be built. In E-DRAM, the algebraic representation of the relationships between the agents in the California economy is achieved with the General Algebraic Modeling System (GAMS). The model currently has 1,100+ equations, exclusive of definitions and of the code to read in and organize the data. All of the model's equations and GAMS code are detailed in Chapter X of the DRAM Report.

3.1.9 Further Documentation

Fuller description of common features shared by E-DRAM and DRAM is available in the report cited above. The primary contents of that report, the presentation of which mirrors the sequence of tasks involved in building DRAM, are as follows. In Chapter II of the DRAM Report, the major agents in the economy are identified and aggregated into sectors. These aggregates are constructed to focus the model on the major industries, taxpayers, and government agencies in the California economy. Data sources are also identified.

Chapters III through VIII of the DRAM Report review the literatures, functional forms, and elasticities relevant to the six primary behavioral equations that link all the various sectors of the model and drive its results. Chapter III of the DRAM Report reviews the literature on the economic behavior of households with respect to

consumption and savings decisions. The literature on the production decisions of firms is examined in Chapter IV of the DRAM Report. Chapter V of the DRAM Report summarizes the literature on international and interregional trade. Investment theory is discussed in Chapter VI of the DRAM Report. Chapter VII of the DRAM Report covers the literature on regional labor-supply response to taxation and economic growth, while the literature on migration and economic growth is examined in Chapter VIII of the DRAM Report.

After establishing the sectoring scheme, data sources, and behavioral equations for the model, all that remains before the actual model can be built is a description of the model-closure rules. Closure rules concern the mathematics of insuring that a solution exists to the 1,100+ equations of the model. Model closure is developed in Chapter IX of the DRAM Report.

Chapter X of the DRAM Report describes the mathematical and corresponding GAMS notation for each equation in DRAM. It is a technical description of the complete California DRAM.[36] Chapter XI of the DRAM Report presents some sensitivity analyses.

Appendices follow Chapter XI of the DRAM Report. They include the original literature search by Dr. Berck and Mr. Dabalen in the summer of 1995, explanations of notational methods used, lists of parameter and variable names used in the mathematical and software input files, and printed copies of the input files themselves.

The updating to the 2003 base year is documented at http://are.berkeley.edu/~peter/Research/DRAM03B/OverviewIII_1018.doc.

The most recent updating is documented at http://are.berkeley.edu/~peter/Research/2003_sam_and_edram.htm.

Particularly, see "Construction of SAM" for technical details and spread sheet models. See SAM120 for the basic models. See "Predicting Future Years" for an explanation of how the future SAMs were calibrated to data on employment, income, and the like.

[36] See Berck, Hess, and Smith (1997) for revisions to the consumer demand portion of the model. Modification of equations from DRAM to E-DRAM are discussed in Berck and Hess (2000). Changes introduce parameters that facilitate running policy scenarios as some combination of price, intermediate good, and/or investment changes.

3.2 Sector Base Data Modification

E-DRAM's original industrial accounts are national accounts scaled to the state level using California employment data. These accounts do not give the same values as the Energy Information Administration does for California energy usage and production. We have used the Energy Information Administration data for these accounts in preference to the estimates derived from the industrial accounts.

3.2.1 Extrapolation from 2003 to 2020

The E-DRAM is not a forecasting model but, rather, a model constructed to exactly reproduce the economic conditions of calendar year 2003. To answer questions concerning the impacts of emission reduction strategies far into the future, E-DRAM must be augmented to reflect future conditions. To "rebase" E-DRAM, i.e., move from a model of the 2003 economy to model of the economy in 2020, E-DRAM's input data must be modified to reflect economic conditions in those "out years." The following process leaves the basic structure of economic relationships intact while scaling up 2003 monetary and employment data using state personal income (SPI), population, and industry-specific forecasts.

The transformation of the 2003 SAM into the 2020 SAM was based on the projected changes to personal income, population, and energy. The sources for these projections were as follows:

Personal-income growth.
The California Personal-income Growth data and California Consumer Price Index data are taken from the DOF. The annual percentage change of both is taken, and then the real growth percentage is determined by taking the differences of the percentage changes. This is done for years 2004-2020.

Working population growth (ages 18-64).
The California working population forecast through 2050 is from the DOF.

Refinery growth.
The factors assume a 0.5 percent growth rate in the refining and gas-producing sectors.

Oil and gas extraction growth.
The growth rates are based on the assumption that the gas and oil extraction sector of California will halve its production by 2020 (starting 2003). This is equivalent to a 4 percent fall in output each year and continues after 2020 at the same rate.

Natural gas per dollar efficiency.
The natural gas per unit of Gross State Product is calculated from the University of California, Davis, Advanced Energy Pathways baseline demand scenario reports.

Electricity per dollar efficiency.
The electricity per unit of Gross State Product is calculated from the University of California, Davis, Advanced Energy Pathways baseline demand scenario reports.

Fuel per dollar efficiency.
The California Energy Commission estimates of total fuel use (gas and diesel) for future years are used to calculate the per unit of Gross State Product usage of fuel.

The basic method of projection is first to increase the size of all values in the SAM by the projected increase in personal income and then to increase or reduce the rows and columns pertaining to the specific energy sectors by their intensities. The result of this exercise is that California in the future is predicted to have the same basic industrial structure as it does today, except that the named sectors generally grow more slowly than the economy as a whole. As a result, California is predicted to be more energy efficient over time.

3.2.2 Adjusting for Technological Change

As described in Berck and Hess (2000), the original E-DRAM allows for changes in production technology. Each industrial sector in E-DRAM is implicitly characterized by a production function that relates output to factor (capital and labor) and intermediate inputs. Technological change is modeled by altering the relationships of input mix per unit of output as follows. Industry J's demand for intermediates from industry I's per unit of output is governed by production parameters AD(I,J), which are input-output coefficients calculated from primary data contained in the SAM. These coefficients can be altered via technology multiplier parameters REG1(I,J). Changing REG1(I, industry J label) from its default setting of unity to 0.9, for example, simulates a technological change enabling one unit of industrial good J to be produced using only 90 percent of the intermediate inputs (from all 120 industries) previously required. Specifying AD(industry I label, industry J label) = 0.9, in contrast, simulates a technological change enabling one unit of good J to be produced using 90 percent of the intermediate inputs previously required from industry I (with inputs from the 119 other industries unchanged).

Similarly, there are expenditure pattern multipliers for government spending. For state spending, REG18(I,G) increases the expenditure from government G to sector I while decreasing the expenditure to all other sectors so as to keep the total expenditure constant.

3.3 Conclusion

This model overview summarizes the essence of the E-DRAM for the California economy. As stated earlier, E-DRAM describes the relationship among California producers, California households, California governments, and the rest of the world. The E-DRAM, like all other empirical economic models, treats aggregates rather than individual agents. For this it combines similar agents into single sectors. In the E-DRAM model, the California economy has been divided into 186 distinct sectors.

To answer questions concerning the impacts of emission reduction strategies far into the future, the model uses specific growth factors to model future years. To "rebase" E-DRAM, i.e., move from a model of the 2003 economy to model of the economy in 2020, E-DRAM's input data must be modified to reflect economic conditions in those "out years." This process leaves the basic structure of economic relationships intact while scaling up. Overall, the measures and changes in expenditure patterns are captured in the E-DRAM model as changes in technology and changes in government and personal expenditure patterns.

Attachment 1. Sectors Used for the E-DRAM Model

SECTOR DESCRIPTION
Agriculture, Forestry and Fishing
Agriculture
Cattle
Dairy
Forestry
Mining
Petroleum and Natural Gas Extraction
Mining
Utilities
Electrical Power Generation and Distribution
Natural Gas Distribution
Water Distribution and Sewage Treatment
Construction
Residential Construction
Nonresidential Construction
Street and Bridge Construction
Utility Infrastructure Construction
Other Construction-related Industry
Manufacturing
Food Manufacturing
Food Processing
Other Food Related Industry
Beverage and Tobacco Products
Textile and Leather Manufacturing
Apparel Manufacturing
Wood Products Manufacturing
Pulp and Paper Mills
Paper Products Manufacturing
Printing
Oil Refineries
Industrial Gas
Chemical and Drugs Manufacture
Basic Chemical Manufacture
Soaps and Detergents Manufacture
Other Chemical Products Manufacture
Plastics Manufacture
Glass Products Manufacture
Cement
Concrete

SECTOR DESCRIPTION
China and Clay Products
Primary Metals
Aluminum
Metal Fabrication
Machinery Manufacture
Refrigeration and Air Conditioning
Computer Manufacture
Communications Equipment Manufacture
Electronic Components Manufacture
Electronic Instruments Manufacture
Electronic Recording Media Manufacture
Electrical Equipment Manufacture
Automobile Manufacturing
Other Vehicle Manufacture
Motor Vehicle Body Manufacture
Motor Vehicle Parts Manufacture
Ship Building and Repair
Other Vehicle Manufacture
Aerospace Manufacture
Furniture
Laboratory and Dental Equipment
Miscellaneous Manufacturing
Wholesale Trade
Vehicle Services
Wholesale Durable Goods
Wholesale Non Durable Goods
Wholesale Gas
Wholesale Trade
Transportation and Warehousing
Transportation
Air Transportation
Railroad Transportation
Waterway Transportation
Truck Transportation
Public Transportation
Other Transportation
Vehicle Transportation
Retail Trade
Retail Vehicles and Parts

SECTOR DESCRIPTION
Retail Furniture
Retail Electronics and Appliances
Retail Building Materials
Retail Food and Beverage
Retail Health and Personal Care
Retail Gasoline Stations
Retail Clothing and Accessories
Retail Sporting Goods, Books, Music
Retail General Merchandise
Retail Miscellaneous
Retail Nonstore
Information
Motion Picture Industry
Other Broadcasting and Recording Industry
Telecommunications
Internet and Information Services
Finance, Insurance and Real Estate
Financial Securities
Insurance
Banking
Real Estate
Other Financial
Services
Legal Services
Accounting
Architecture
Design
Computer Related Services
Consulting
Research
Advertising
Other Professional Services
Business Services
Temporary Administrative Services
Security Services
Building Maintenance
Other Administrative Services
Waste Management
Landfills
Education
Medical Services
Hospitals

SECTOR DESCRIPTION
Nursing
Day Care
Recreation and Entertainment
Amusement Parks
Hotels
Full Service Restaurants
Fast Food
Caters and Mobile Food Services
Drinking Establishments
Personal Services
Labor and Capital Factors
FACTOR FACTOR LABOR
FACTOR FACTOR ALL OTHER FACTORS COMBINED AS CAPITAL
Commodity
COMMODITY FOOD AND BEVERAGE
COMMODITY SHELTER
COMMODITY FUEL AND UTILITIES
COMMODITY HOUSEHOLD FURNISHING AND OPERATION
COMMODITY APPAREL AND ITS UPKEEP
COMMODITY TRANSPORTATION
COMMODITY MEDICAL CARE
COMMODITY ENTERTAINMENT
COMMODITY OTHER GOODS AND SERVICES
California Marginal Personal Income Tax Brackets
HOUSEHOLD 0.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 1.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 2.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 4.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 6.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 8.0 PERCENT MARGINAL CA PIT
HOUSEHOLD 9.3 PERCENT MARGINAL CA PIT UNDER 200K
HOUSEHOLD 9.3 PERCENT MARGINAL CA PIT OVER 200K
INVESTMENT
INVESTMENT

SECTOR DESCRIPTION
GOVERNMENT
GOVERNMENT FEDERAL TAX SOCIAL SECURITY
GOVERNMENT FEDERAL TAX PERSONAL INCOME TAX
GOVERNMENT FEDERAL TAX PROFITS
GOVERNMENT FEDERAL TAX DUTY
GOVERNMENT FEDERAL TAX MISCELLANEOUS
GOVERNMENT CALIFORNIA TAX VARIOUS HOUSEHOLD TAXES
GOVERNMENT CALIFORNIA TAX ALCOHOL TAXES
GOVERNMENT CALIFORNIA TAX CIGARETTE TAXES
GOVERNMENT CALIFORNIA TAX HORSE RACING
GOVERNMENT CALIFORNIA TAX ESTATE TAXES
GOVERNMENT CALIFORNIA TAX TRAILER FEES
GOVERNMENT CALIFORNIA TAX MOTOR VEHICLE LICENSE FEES
GOVERNMENT CALIFORNIA TAX DIESEL FUEL TAXES
GOVERNMENT CALIFORNIA TAX MOTOR VEHICLE REGISTRATION FEES
GOVERNMENT CALIFORNIA TAX MISCELLANEOUS
GOVERNMENT CALIFORNIA TAX INSURANCE GROSS PREMIUM TAX
GOVERNMENT CALIFORNIA TAX GASOLINE FUEL TAXES
GOVERNMENT CALIFORNIA TAX SALES AND USE TAXES
GOVERNMENT CALIFORNIA TAX BANK AND CORPORATION TAX
GOVERNMENT CALIFORNIA TAX LABOR TAXES UI AND WORKERS COMP
GOVERNMENT CALIFORNIA TAX PERSONAL INCOME TAX
GOVERNMENT CALIFORNIA TAX REGULATORY LICENSES AND FEES
GOVERNMENT CALIFORNIA TAX SERVICES TO THE PUBLIC
GOVERNMENT CALIFORNIA TAX USE OF PROPERTY AND MONEY

SECTOR DESCRIPTION
GOVERNMENT CALIFORNIA GENERAL FUND
GOVERNMENT LOCAL TAX PROPERTY
GOVERNMENT LOCAL TAX SALES AND USE
GOVERNMENT LOCAL TAX MISCELLANEOUS ON FIRMS
GOVERNMENT LOCAL TAX MISCELLANEOUS ON HOUSEHOLDS
GOVERNMENT LOCAL TAX MISCELLANEOUS ON FIRMS AND HOUSEHOLDS
GOVERNMENT FEDERAL SPENDING DEFENSE
GOVERNMENT FEDERAL SPENDING NON DEFENSE
GOVERNMENT CALIFORNIA SPENDING TRANSPORTATION
GOVERNMENT CALIFORNIA SPENDING CORRECTIONS
GOVERNMENT CALIFORNIA SPENDING K TO 14 EDUCATION
GOVERNMENT CALIFORNIA SPENDING UNIVERSITIES
GOVERNMENT CALIFORNIA SPENDING WELFARE
GOVERNMENT CALIFORNIA SPENDING HEALTH
GOVERNMENT CALIFORNIA SPENDING OTHER
GOVERNMENT LOCAL SPENDING TRANSPORTATION
GOVERNMENT LOCAL SPENDING CORRECTIONS
GOVERNMENT LOCAL SPENDING K TO 14 EDUCATION
GOVERNMENT LOCAL SPENDING WELFARE
GOVERNMENT LOCAL SPENDING HEALTH
GOVERNMENT LOCAL SPENDING OTHER
REST OF WORLD /
REST OF WORLD /

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Appendix G: Economic Analysis
Appendix G-III
Economic Analysis of California Climate Policy Initiatives Using the Berkeley Energy and Resources (BEAR) Model

This appendix is not included because the BEAR model was not run for the Recommendation in the Scoping Plan. For results from the BEAR model, see the Economic Analysis Supplement to the Draft Scoping Plan.

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Appendix G: Economic Analysis
Appendix G-IV
Calculation of Household Savings by Income Group

1. INTRODUCTION

This appendix provides additional background on the calculation of the potential effects of the Recommendation from the Scoping Plan on households as discussed in Section 2.3 of Appendix G. To evaluate these effects, we first determined consumer expenditures on major goods and services as a function of income levels and household size. Then, we adjusted those expenditures based on the non-energy price changes reflected in the E-DRAM modeling of the Recommendation. Finally, we factored in additional savings from energy efficiency improvements for the residential and transportation sectors, including the Pavley regulation (Light-Duty Vehicle GHG Standards). The results from these calculations indicate a net annual savings of $400 to $500 per household for the various income categories – two percent or less of total household expenditures – due to implementation of the Recommendation.

2. CALCULATION OF HOUSEHOLD SAVINGS BY INCOME GROUP

To assess the impacts of projected price changes, we used household expenditure data from the Bureau of Labor Statistics' Consumer Expenditure Survey (2005-2006)[37] to obtain budget shares devoted to major consumer categories for different income groups. The budget shares for low- and higher-income households are shown in Table G-IV-1.

Because the precise effects of the Recommendation on non-energy household consumption are unclear, we assume that it remains constant as a conservative starting point. This assumption allows current expenditures to serve as a proxy for consumption levels. Constant consumption implies that households are not adjusting their purchasing in response to price changes. Combining the consumer expenditure patterns with E-DRAM's projected price changes for each non-energy category[38] yields an estimate of total change in household expenditures for these major goods and services.

[37] The survey is weighted for the entire nation and not for specific state-level analysis.
[38] In some cases, several E-DRAM industrial sectors are aggregated to form a single expenditure category, e.g. food comprises both food consumed at home and away from home.

Table IV-1: Budget Shares for Major Expenditure Categories by Income Group in 2005-2006

Expenditure Category	Percent of Household Budget Spent for Each Household Income Level			
	100% Poverty	200% Poverty	Middle Income(1)	High Income(2)
Housing	22%	21%	18%	18%
Food	17%	15%	14%	12%
Healthcare	6%	7%	6%	5%
Gasoline and motor oil	5%	5%	5%	4%
Apparel and services	5%	5%	4%	4%
Electricity	4%	4%	3%	2%
Entertainment	4%	4%	5%	5%
Vehicle maintenance, repair, insurance	3%	3%	3%	3%
Education	3%	2%	2%	2%
Natural Gas	2%	1%	1%	1%
Water	1%	1%	1%	1%
Other (e.g. taxes, social security payments, vehicle purchases, charitable donations, personal care products/services, etc.)	27%	31%	38%	44%

Source: Bureau of Labor Statistics, Consumer Expenditure Survey, Two-Year Cross Tabs 2005-2006

1 All households between 200% and 400% of the poverty guidelines. Note that "$70,000 or more" is the highest income bracket reported in the Consumer Expenditure Survey. For households of four or more, 400% of the poverty guidelines exceeds $70,000. In these cases, half of the households were assumed to be uniformly distributed between $70,000 and the average income reported for this bracket and household size category to distinguish between middle and high income households.

2 All households above 400% of the poverty guidelines. See previous footnote as well.

As shown in Table G-IV-2, for most major expenditure categories, such as gasoline, food, apparel, and healthcare, E-DRAM projects essentially no change in price (less than one percent and generally a price decrease). However, for the Recommendation, electricity and natural gas prices are projected to increase eleven and eight percent, respectively.[39] With the exception of electricity and natural gas expenditures, applying these price changes to current expenditure patterns yields the change in total expenditures resulting from price effects alone (i.e., no changes in consumption levels due to improved efficiency or demand response). The treatment of electricity and natural gas expenditures is described below. Overall, the price

[39] E3's analysis shows a slightly larger increase in average statewide rates of 14 percent, however also shows a net decrease in overall statewide bills.

effects alone would not significantly change household expenditures in these categories across all household groups, assuming that households do not change consumption in response to new prices.

Table G-IV-2. E-DRAM Projected Price Changes in 2020 for Select Sectors

Category	Preliminary Recommendation
Owned dwellings	0.0%
Rented dwellings	0.0%
Food at home	-0.1%
Food away from home	-0.7%
Healthcare	-0.6%
Gasoline and motor oil	0.1%
Apparel and services	-0.6%
Electricity	11.3%(1)
Entertainment	-0.5%
Vehicle maintenance and repair	-0.3%
Vehicle insurance	-0.2%
Education	-0.4%
Natural Gas	7.9%(2)
Water	-0.1%

Shaded rows indicate increasing prices; Unshaded rows show decreasing prices

1 Although E-DRAM projects a price increase for electricity, E3's analysis estimates an overall 5% decrease in electricity bills. The change in bills is more representative of changes in household expenditures. Thus, for this analysis -5% is used for the change in the electricity sector.

2 Although E-DRAM projects a price increase for natural gas, the analysis conservatively balances this increase with the estimated 29 percent overall decline in natural gas use in California by assuming no change in natural gas bills.

For the electricity sector, many measures in the Scoping Plan are expected to improve end-use electricity efficiency and reduce consumption levels. Total bills will vary depending on the type of customer (e.g. commercial or residential), customer usage patterns, opportunity for reductions in usage from energy efficiency and/or change in practices, and the rate structure of the electricity provider. Because utility rates are adjusted to collect total utility costs over time, though, a forecast of total utility costs can serve as a proxy for the electricity bills of all customers in the State. Based on projections by Energy and Environmental Economics, Inc.'s (E3) GHG Spreadsheet Calculator for the Joint CEC/CPUC Proceeding on AB 32 (CPUC Rulemaking 06.04.009, CEC Docket 07-OIIP-01), total utility costs for all customers statewide are expected to be approximately five percent lower than the base case

in 2020.[40] Their finding is that the utility savings attributed to energy efficiency and CHP more than make up for the additional costs in the electricity sector. However, as previously discussed, changes to individual entities will deviate from the average and the E3 analysis does not predict how these savings will be distributed among customers. For purposes of this analysis, we assume a household's total electricity bill decreases by five percent on average, which is more representative of the changes to a household's expenditures than just the change in electricity price.

For natural gas, E-DRAM projects a price increase of eight percent. We have estimated that the measures in the Recommendation will result in an overall 29 percent decrease in natural gas consumption in California. As a conservative estimate that balances the projected price increase with the estimated decline in natural gas consumption, we have assumed no change in natural gas bills for the purposes of this analysis.

In addition, the Pavley regulation (Light-Duty Vehicle GHG Standards) is likely to further enhance the savings to households. The cumulative savings to the household will largely depend on when households are able to purchase either a new or used Pavley vehicle. Based on the economic evaluation conducted during the Pavley rulemaking process, low-income households could expect to save about 100 gallons of gasoline each year by driving a Pavley-compliant vehicle. Using the projected gas prices of $3.67 per gallon in 2020 (in terms of 2007 dollars), low-income households would save about $360 in fuel alone in 2020 relative to business-as-usual. Factoring in the additional annualized cost of about $50 for a used Pavley-compliant vehicle (LT2) yields net savings of approximately $300 per year. For higher income households purchasing new vehicles and traveling more miles, the net savings total roughly $400 per year. The findings from this analysis would change if based on different assumptions for fuel prices and/or vehicle costs. For example, to the extent that fuel prices are higher the savings would be greater.

The household savings presented in Table G-IV-3 were calculated as follows:

- Multiply the average household expenditures for each major category and income group by the price changes projected by E-DRAM for the Recommendation. For the electricity category, replace electricity price changes with -5 percent to reflect the average reduction in electricity bills as estimated by E3. For the natural gas category, replace the natural gas price change with a zero percent change to reflect the balance between increased prices and decreased use of natural gas.
- Sum the changes for all of the categories.
- Add the net Pavley savings to the total change under the Recommendation. For low-income households, net savings from Pavley equal $300; for higher income households (greater than 200% of the federal poverty guidelines), net savings total $400. No distinction was made between middle or high income households in vehicle type purchase or annual vehicle miles traveled.
- Final estimates are rounded to one significant digit.

[40] The E3 analysis focuses on direct programmatic measures and does not include the incremental price impact of the cap and trade program, which will depend upon allowance price, allocation strategy, the capped sector industry response, and other program design decisions.

Table G-IV-3: Total Estimated Household Savings by Income Group in 2020 (2007 $) Due to Implementation of the Recommendation

	100% Poverty	200% Poverty	Middle Income[a]	High Income[b]	All Households[c]
Total Savings	$400	$400	$500	$500	$500
Share of Total Expenditures	2%	2%	1%	1%	1%

[a] All households between 200% and 400% of the poverty guidelines.
[b] All households above 400% of the poverty guidelines.
[c] Average of households of all income levels.

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Appendix G: Economic Analysis
Appendix G-V
Impacts on Businesses

1. INTRODUCTION

This appendix provides additional background on the calculation of the potential effects of the Recommendation from the Scoping Plan on business, particularly small business. Section 38560(e) of the California Global Warming Solutions Act of 2006 (AB 32) requires the Air Resources Board to consider the potential for adverse effects on small businesses when developing its Scoping Plan. The Recommendation in the Plan promotes energy efficiency through better management of energy resources and the use of more energy efficient technologies, which is expected to more than offset likely increases in the unit price of energy. On balance, the Recommendation is expected to reduce electricity expenditures for average California customers by 5 percent in 2020 relative to business-as-usual according to a recent analysis by Energy and Environmental Economics, Inc. (E3).[41] Based on estimates of reduced natural gas use in California, similar declines in average natural gas bills are also likely. We estimate that total natural gas use in California will decrease by 29 percent, which would more than offset the approximately 9 percent increase in natural gas prices estimated by E-DRAM. Because both the projected decrease in natural gas use and the price increase are aggregate figures for all of the California economy, this analysis conservatively uses an estimate of no change in natural gas bills. Natural gas market complexity, vast differences in business energy consumption characteristics, combined with a lack of adequate data prevent a more detailed analysis of such savings. Further, the transportation measures in the Plan will bring about significant savings to businesses that rely heavily on transportation fuels for their business. However, for the analysis presented here, there is not sufficient data to represent the benefits to business due to reduced consumption of transportation fuels resulting from measures in the Plan.

[41] Recent analysis from Energy and Environmental Economics, Inc. [based on their GHG Calculator, CPUC/CEC GHG Docket (CPUC Rulemaking.06.04.009, CEC Docket 07-OIIP-01), available at http://www.ethree.com/cpuc_ghg_model.html] forecasts that a package of greenhouse gas reduction measures similar to the Recommendation in the Proposed Scoping Plan would deliver a 5 percent decrease in electricity expenditures relative to business-as-usual in 2020. This change is being used as a proxy for the bill impacts for the average California electricity customer. Changes to individual entities will deviate from the average and the E3 analysis does not predict how these savings will be distributed among customers. The E3 analysis focuses on direct programmatic measures and does not include the incremental price impact of the cap and trade program, which will depend upon allowance price, allocation strategy, the capped sector industry response, and other program design decisions.

The analysis presented in this section provides a financial assessment of the impacts of the Recommendation on California businesses. The assessment resulted in the following findings.

- Businesses in general are expected to experience no significant change in total energy costs.
- Small businesses in almost every industry spend a greater percentage of revenue on energy than large businesses.
- As a result of implementing the Recommendation, California business ranking in terms of electricity expenditures per dollar of sales would change from 7th highest to the 19th highest in the nation, considerably improving California business competitive position vis-à-vis out-of-state businesses.
- Large businesses are likely to be more responsive to the changes required by the Scoping Plan than small businesses because of their greater ability to invest in energy efficient technologies to achieve energy savings, thus underscoring the need to explore options for assisting small business during the implementation of the plan.

2. DATASETS

Under a contract to ARB, Dun and Bradstreet (D&B) created a statistical data model that estimates the portion of revenue that businesses spend on electricity and natural gas bills. The model is based on all of D&B marketing files of approximately 17 million businesses nationwide including over 2.1 million from California. The annual spending on electricity was calculated for affected businesses as follows:

- D&B collected monthly electrical bills data for approximately 628,000 businesses from 18 electrical utility providers nationwide, including two California utilities from April 2007 to March 2008.
- Annual spending on electricity was calculated for these businesses by summing up monthly bills.
- Of the 628,000 businesses nationwide for which D&B collected electricity bill data, D&B had revenue data for 210,000 businesses.
- Revenue data were available for a greater number of large businesses in the sample. Thus, the sample distribution was adjusted to represent the true universe distribution of the D&B database of 17 million businesses.
- Analysis of the data was provided based on a number of characteristics such SIC (Standard Industrial Classification) Code, business size.

The D&B data on natural gas spending were not as extensive as its data on electricity spending. However, D&B provided data on natural gas spending for several industries at the national level. These data, along with electricity spending data, were used to form a complete picture of the impact that energy price changes may have on small business due to implementation of the Recommendation in the Plan.

3. METHODOLOGY

The Scoping Plan measures are expected to change the energy costs for most businesses in California. The change in energy spending by California businesses may alter their profitability, thus the need for the analysis. Since profitability data were not available for businesses in the D&B database, the change in energy spending as a percentage of revenue was used as a proxy for the change in business before-tax profitability, though this method does not account for changes in economic output from implementing the Recommendation. Estimating the change in energy spending by businesses provides a snapshot analysis of the likely impact that energy costs may have on businesses in California.

The calculations were based on the following assumptions:

1) D&B national data were used to calculate business electricity and natural gas spending as a percentage of revenue;
2) Based on expert opinions, the average electricity bill for all California customers is expected to decline by about 5 percent relative to business-as-usual, which was assumed to represent the average bill impact for California businesses;
3) Expenditures for natural gas are assumed to remain the same as a conservative assumption, based on the projected 29 percent decrease in natural gas consumption in California and E-DRAM's projected natural gas price increase of approximately 9 percent;
4) Data on natural gas spending were only available for industries nationwide. Spending on natural gas for a typical California firm in each industry is expected to be similar to a typical national firm in that industry.

4. BUSINESS COMPETITIVENESS

California ranked 7th in the nation based on the percentage of revenue a business, on the average, spends on the electricity (Table G-V-1). California businesses are currently spending less than 3 percent of their revenues on electricity. As stated above, the average electricity bill for businesses is expected to decline by 5 percent in 2020 as a result of the Scoping Plan relative to business-as-usual. A 5 percent decline in the electricity spending for business would favorably push back California's ranking from 7th highest to 19th highest in the nation, considerably improving California's competitive position compared to other states.

Table G-V-1. Spending on Electricity as a Percentage of Revenue by State

State	Business No.	Before Regulation		After Regulation	
		%Spending	Ranking	%Spending	Ranking
Georgia	595,952	3.26	1	3.26	1
Louisiana	226,355	3.26	2	3.26	2
Arizona	300,690	3.24	3	3.24	3
Wisconsin	289,720	3.10	4	3.10	4
Alaska	39,518	3.05	5	3.05	5
Montana	307,026	3.00	6	3.00	6
California	**2,152,141**	**2.94**	**7**	**2.79**	**19**
Maine	73,452	2.90	8	2.90	7
West Virginia	70,068	2.90	9	2.90	8
Washington DC	47,506	2.90	10	2.90	9
Wyoming	38,782	2.90	11	2.90	10
Vermont	43,492	2.89	12	2.89	11
South Dakota	53,703	2.88	13	2.88	12
Indiana	104,859	2.87	14	2.87	13
New Mexico	96,922	2.86	15	2.86	14
Montana	71,842	2.84	16	2.84	15
Delaware	45,393	2.84	17	2.84	16
Hawaii	61,410	2.83	18	2.83	17
North Dakota	44,066	2.81	19	2.81	18
Arkansas	142,205	2.79	20	2.79	20

Table G-V-2 displays the percentage of the revenues spent on electricity for the top 20 California industries compared to the same industries nationwide. For most industries, California businesses spend slightly more on electricity than similar businesses nationwide. However, the majority of the listed business categories are those that serve local markets such as trailer parks and camps, hotels, barbershops, coin-operated laundries, etc. Out-of-state businesses cannot serve these local markets. As a result, California businesses are unlikely to experience a competitive pressure from out-of-state businesses to lower the prices of their products; therefore, they experience increased profitability if their electricity costs decline.

Table G-V-2. List of 20 Industries with Highest Percentage of Revenue Spending on Electricity

SIC	Industry Description	CA Average %	US Average %
8641	Civic and Social Associations	8.6	7.6
7032	Sporting and Recreational Camps	8.2	7.7
7033	Trailer Parks and Campsites	8.2	8.2
7021	Rooming and Boarding Houses	7.4	6.8
7219	Laundry and Garment Services, NEC	6.9	6.5
7041	Membership-basis Organization Hotels	6.9	6.4
7241	Baber Shops	6.9	6.3
5461	Retail Bakeries	6.9	6.1
8231	Libraries	6.8	5.8
6719	Holding Companies, NEC	6.6	6.1
5813	Drinking Places	6.4	6.0
7011	Hotels and Motels	6.4	6.1
7215	Coin-operated Laundries and Cleaning	6.2	5.5
7231	Beauty Shops	6.2	5.8
7217	Carpet and Upholstery Cleaning	6.1	5.5
5441	Candy, Nut, and Confectionery Stores	6.0	5.5
4941	Water Supply	6.0	5.8
0259	Poultry and Egg, NEC	5.9	6.4
8351	Child Day Care Services	5.9	5.4
8361	Residential Care	5.8	5.2

Note: NEC: Not elsewhere classified.

Table G-V-3 provides cumulative spending on both electricity and natural gas for the listed industries. As shown, total electricity and natural gas expenditures as a percentage of revenue for the twenty highest affected industries in California varies from a high of 22.2 percent to a low of 7.8 percent.

Table G-V-3. List of Top 20 Industries California with Highest Percent of Revenue Spending on Energy Without the Scoping Plan

SIC	Industry Description	%Spending on Electricity	%Spending on Natural Gas	%Spending Total
7215	Coin-operated Laundries and Cleaning	6.2	16.0	22.2
7219	Laundry and Garment Services, NEC	6.9	8.4	15.3
8641	Civic and Social Associations	8.6	5.8	14.4
7021	Rooming and Boarding Houses	7.4	6.9	14.3
7041	Membership-basis Organization Hotels	6.9	6.8	13.7
7033	Trailer Parks and Campsites	8.2	5.1	13.3
7241	Baber Shops	6.9	5.0	11.9
6719	Holding Companies, NEC	6.6	5.2	11.8
7011	Hotels and Motels	6.4	4.9	11.3
7032	Sporting and Recreational Camps	8.2	2.8	11.0
8351	Child Day Care Services	5.9	4.4	10.3
5461	Retail Bakeries	6.9	3.2	10.1
8231	Libraries	6.8	3.3	10.1
5813	Drinking Places	6.4	3.6	10.0
7231	Beauty Shops	6.2	3.7	9.9
7217	Carpet and Upholstery Cleaning	6.1	1.9	8.9
8361	Residential Care	5.8	3.1	8.9
4941	Water Supply	6.0	2.7	8.7
5441	Candy, Nut, and Confectionery Stores	6.0	1.8	7.8
0259	Poultry and Egg, NEC	6.0	n.a.	n.a.

Notes: NEC: Not elsewhere classified
n.a.: not available.

Assuming that the Recommendation in the Plan decreases electricity expenditures in California by 5 percent and leaves natural gas expenditures unchanged, the average percent of revenue spent on energy by California firms in Table G-V-3 will decrease by 0.3 percent for the coin-operated laundries and cleaning businesses (high end users), and also decline by 0.3 percent for Candy, Nut, and Confectionery businesses (the low end users). Table G-V-4 recreates the 20 top high users of combined electricity and natural gas in Table G-V-3 after the expenditure effects are reflected. Most businesses experience no significant change in their energy expenditures.

Table G-V-4. List of Top 20 Industries California with Highest Percent of Revenue Spending on Energy With the Scoping Plan

SIC	Industry Description	%Spending on Electricity	%Spending on Natural Gas	%Spending Total
7215	Coin-operated Laundries and Cleaning	5.9	16.0	21.9
7219	Laundry and Garment Services, NEC	6.6	8.4	15.0
8641	Civic and Social Associations	8.2	5.8	14.0
7021	Rooming and Boarding Houses	7.0	6.9	13.9
7041	Membership-basis Organization Hotels	6.6	6.8	13.4
7033	Trailer Parks and Campsites	7.8	5.1	12.9
7241	Baber Shops	6.6	5.0	11.6
6719	Holding Companies, NEC	6.3	5.2	11.5
7011	Hotels and Motels	6.1	4.9	11.0
7032	Sporting and Recreational Camps	7.8	2.8	10.6
8351	Child Day Care Services	5.6	4.4	10.0
5461	Retail Bakeries	6.6	3.2	9.8
8231	Libraries	6.5	3.3	9.8
5813	Drinking Places	6.1	3.6	9.7
7231	Beauty Shops	5.9	3.7	9.6
7217	Carpet and Upholstery Cleaning	5.8	1.9	7.7
8361	Residential Care	5.5	3.1	8.6
4941	Water Supply	5.7	2.7	8.4
5441	Candy, Nut, and Confectionery Stores	5.7	1.8	7.5
0259	Poultry and Egg, NEC	5.7	n.a.	n.a.

Notes: NEC: Not elsewhere classified
n.a.: not available.

5. SMALL BUSINESS IMPACT

As stated, the D&B data on natural gas spending were not as extensive as its data on electricity spending. The following analysis, thus, could only be performed based on

business electricity spending in the United States. Classifications of business expenditures on electricity by employee size show that small businesses tend to spend a larger share of their business expenditures on electricity than larger businesses. Thus, a reduction in electricity expenditures is expected to benefit small businesses relatively more than large businesses.

The smaller a business is, the larger its share of spending on electricity. As shown in Figure G-V-1, small businesses with a single employee spend 3.3 percent of each sales dollar on electricity, while businesses with 500 or more employees spend only 0.30 percent. This represents 11 times greater spending on electricity as a percentage of revenue for small businesses than for large businesses. A 5 percent reduction in electricity expenditures would reduce small business spending on electricity from 3.3 percent to 3.1 percent of each sales dollar while reducing large business spending from 0.30 to 0.29 percent of each sales dollar.

Figure G-V-1. Percent of Revenue Spending on Electricity by Business Employee Size

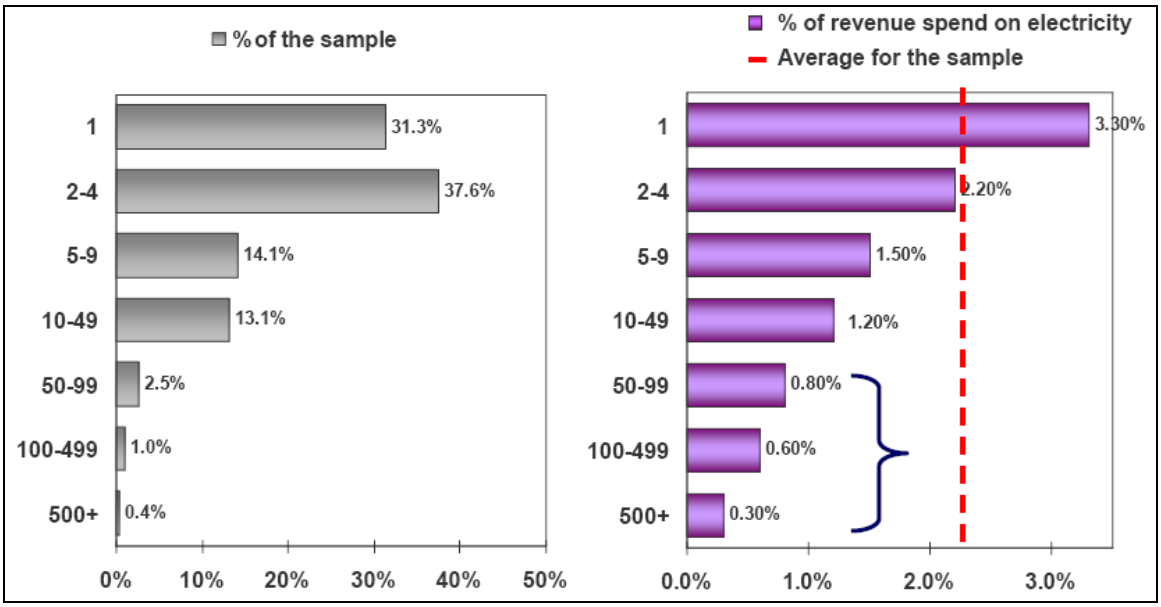
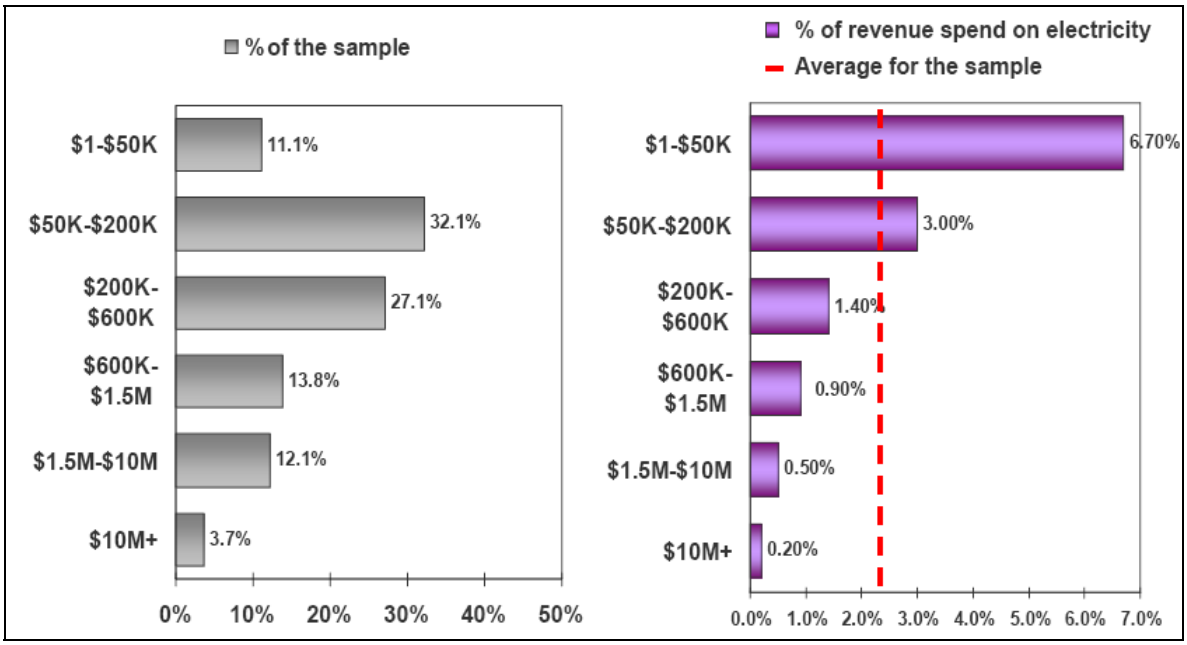


Figure G-V-2 shows that the U.S. businesses with smaller sales spend much higher percentages on electricity than larger businesses. Small businesses earning less than $50,000 in sales spend 34 times more on electricity as a percentage of revenue than large businesses with $10 million or more in sales. A five percent reduction in electricity expenditures would reduce small business spending on electricity from 6.7 percent to 6.4 percent of each sales dollar while reducing large business spending on electricity from 0.20 percent to 0.19 percent of each sales dollar. Generally, the smaller a business is, the larger the benefit it receives from a reduction in energy expenditures.

Businesses in general are expected to experience no significant change in energy costs although businesses that currently spend more on natural gas per dollar of sales will experience slight increase in their total energy costs.

Figure G-V-2. Percent of Revenue Spending on Electricity by Business Revenue



6. CONCLUSIONS

On average, businesses in California are expected to experience a slight decrease in energy expenditures. Further, any savings from the transportation measures in the Scoping Plan, which are not reflected in this analysis, would yield further benefits.

A reduction in electricity bills will dramatically improve California business competitive position in the nation, moving it from 7th highest to the 19th highest in the nation in terms of electricity expenditures per sales dollar. However, we expect large businesses, especially in the short run, to be more responsive to the changes required by the Scoping Plan than small businesses because of their greater ability to invest in energy efficient technologies to achieve energy savings. These results are consistent with the results of the macroeconomic analysis presented in Appendix G, which shows the overall energy cost savings would stimulate increased economic activity, resulting in increased output and personal income.

Appendix H: Public Health Analysis

Statewide Public Health and Environmental Benefits of Scoping Plan Measures

Regional Assessment of Air Quality-Related Public Health Benefits of Scoping Plan: South Coast Air Basin

Community Level Assessment of Air Quality-Related Public Health Benefits of Proposed Scoping Plan: Wilmington Example

Overview of Regulatory Programs for Criteria and Toxic Air Pollutants in California

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INTRODUCTION

AB 32, the Global Warming Solutions Act of 2006, requires ARB to evaluate the environmental and public health impacts of the Scoping Plan. The analysis of this plan is focused primarily on the quantification of air quality-related public health benefits at statewide, regional, and local scales that would result from implementation of the proposal. Climate change from greenhouse gas pollutants emitted in another state or country have the same potential to damage our public health and the environment as do climate change pollutants emitted within California, and California is only a small part of the overall solution. However, many of the measures aimed at reducing global warming pollutants also provide co-benefits to public health and California's natural resources.

California's actions to reduce greenhouse gas emissions will help transition the State to new technologies, improved efficiencies, and land use patterns also necessary to meet air quality standards and other public health goals. California's challenging public health issues associated with air pollution are already the focus of comprehensive regulatory and incentive programs. These programs are reducing smog forming pollutants and toxic diesel particulate matter at a rapid pace. However, to meet increasingly stringent air quality standards and air toxics reduction goals, transformative changes are needed in the 2020 timeframe and beyond. Implementation of AB 32, will provide additional support to existing State efforts devoted to protecting and improving public health.

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Statewide Public Health and Environmental Benefits of Scoping Plan Measures

1. AB 32 REQUIREMENTS

The Global Warming Solutions Act of 2006 (AB 32) requires the California Air Resources Board (ARB or Board) to evaluate the economic, public health and environmental benefits of the Scoping Plan. ARB must also evaluate the potential for localized effects before implementing market-based compliance programs. This document discusses public health and environmental impacts. Economic impacts are discussed in a separate document.

Addressing climate change effects expands the way we view how our actions affect our environment and our health. In California, there are a number of State agencies dedicated to protecting and restoring the state's environment and improving public health. ARB, through the implementation of the Climate Change Scoping Plan and Appendices, December 2008 (collectively "Scoping Plan"), will meet California's greenhouse gas reduction target in ways that help the State meet other public health and environmental goals. Any adverse environmental impacts will be assessed and mitigated as required by the California Environmental Quality Act (CEQA). The necessary CEQA documents for the Scoping Plan are included as Appendix J.

For the purposes of the Scoping Plan, ARB investigated the recommended measures' potential direct and indirect physical effects on the environment: air quality, water quality and supply, land resources, and biological resources. ARB then used these evaluations to examine the Scoping Plan's potential effects on public health, primarily through changes to air quality, and the potential for localized effects. For the purposes of evaluating implementation of the Scoping Plan, we first established and examined a "business as usual" scenario for absent the Scoping Plan measures. The "business as usual" scenario includes implementation of existing ARB policies and plans such as the Diesel Risk Reduction Plan, the Goods Movement Emission Reduction Plan and the State Implementation Plan for criteria pollutants. ARB then examined each measure to evaluate potential changes the Scoping Plan might cause.

The Scoping Plan describes the framework of the proposed recommendation and Appendix C describes each measure, by sector, in detail. These documents were relied upon and are not necessarily repeated within this evaluation. Measures are described as needed to discuss the related environmental or public health effect.

2. 2020 CONDITIONS WITHOUT AB 32 SCOPING PLAN – BASELINE FOR EVALUATION

There are two main drivers of the 2020 Business As Usual ("BAU" or "No Project") scenario: population growth and current laws and regulations. Population growth in California will result in 2020 conditions with more vehicle miles driven, more fuel used, greater electricity consumption, more consumer products, more goods movement, and greater water demand. Laws and regulations already in place or in process will continue to maintain and even improve our environmental resources, even with population growth.

The following describes the BAU scenario, which is used as a baseline for the evaluation of each proposed or evaluated measure. Descriptions of the 2020 BAU forecasts for the major sectors of the inventory are given below with key assumptions staff used to estimate these future emissions.

Transportation

Petroleum-based fuels supply 96 percent of California's transportation needs and will continue provide a substantial portion into the future. GHG emissions in 2020 from the transportation sector as a whole are expected to increase from current levels to 225.4 million metric tons of carbon dioxide equivalents ($MMTCO_2E$). This forecasted increase is dominated by increases in emissions from on-road transportation, i.e., passenger cars and heavy-duty trucks. To forecast on-road transportation emissions, ARB staff used 2007 fuel sales data obtained from the California Board of Equalization and estimated 2020 emissions based on the growth in projected vehicle miles traveled (VMT) derived from the 2007 Emissions Factor Model (EMFAC2007). This BAU forecast assumes no change in vehicle fleet mix over time. The BAU forecast also assumes no reductions in VMT or airplane traffic due to the High Speed Rail (HSR), although the HSR has completed all of its environmental evaluations (SCH #2001042045) and could proceed independent of AB 32 implementation.

Goods movement activities in California are projected to increase up to 250 percent between 2006 and 2020, as the United States increases its exports and imports in the globalized economy. This increase translates to more ship and truck trips in and around ports, and more truck activity between and at rail yards and distribution centers. Rail trips will probably not increase, as improvements in locomotive efficiencies accommodate larger hauls. Some of this growth may require new infrastructure to relieve traffic congestion and improve efficiencies, such as port and highway expansions. ARB adopted and is implementing a Goods Movement Emission Reduction Plan to reduce emissions from goods movement activities and address regional ozone and particulate matter standards, as well as impacts on already adversely-impacted communities, which can be located near ports, rail yards, and distribution centers.

The 2007 Integrated Energy Policy Report indicates that by 2020, at current trends, more than 44 million Californians will consume more than 24 billion gallons of gasoline and diesel fuel each year. Such increased consumption would require major investments in petroleum refinery and delivery infrastructure expansions. Assembly Bill 1007 (Pavley, 2005) directed the California Energy Resources and Conservation Commission (CEC) and ARB to develop a plan to increase the use of alternative fuels in California, effectively reducing California's demand on

refineries. California's refineries also supply other western states, which are currently expected to increase their demands for gasoline and diesel into the future due to population growth. Fuel diversity has also been identified as a major policy objective in the CEC's *2003 Integrated Energy Policy Report*[3] and the Governor's BioEnergy Executive Order S-06-06 and Bioenergy Action Plan[4].

California's population is continuing to grow at 1.2 percent per year. If the measures in the Scoping Plan are not implemented, land use patterns and decision making will likely continue to foster leap frog development and urban sprawl, which directly relates to a continued increase in VMT, further degradation of air quality, and an increase in detrimental health effects. Most of the gains made by introducing cleaner vehicles and fuels will be eroded unless more efficient methods of urban and community planning, transit choices, and public safety measures are implemented.

Electricity and Natural Gas

Under a business as usual scenario, population growth in California will affect electricity demand in two ways: the number of residents will increase the overall demand for electricity and natural gas, and the location of those residents, primarily in the state's inland areas, will change the pattern of energy use. Trends toward larger homes and increases in electronic equipment will also increase demand. Historically, California's appliance and building efficiency standards were able to hold our per capita electricity and natural gas demands steady, but under a business as usual scenario these programs will not be able to continue this trend through 2020 and new capacity would be needed.[42] As demands increase, older, less efficient and dirtier power plants would be expected to operate more frequently.

The pattern of energy use is important, because the electrical system is sized to accommodate peak demands. The base of the state's electrical demand is a minimum amount of energy demanded by the state all the time. The peak demand is the difference between this base and the maximum amount of energy needed, usually during periods of extreme weather. Power plants that provide base energy are the most cost-effective, because they are run fairly constantly. "Peaker" power plants, on the other hand, can be run as little as 4 hours a day on a few very hot summer days, and the low duration of operation tends to result in higher co-pollutant emissions than their base counterparts on a per MW basis. Power plants are typically dispatched starting with the most efficient sources, which are generally also those with lowest emissions. Under BAU conditions, many new power plants will need to be built in California to accommodate load growth and to replace the existing fleet of aging power plants that have low efficiencies and relatively high co-pollutant emissions. There are also several coastal plants that could be closed in response to proposed environmental requirements for their once-through cooling systems.[43]

Power plants are typically located close to power recipients, suggesting that new power plants would most likely follow population growth in the state. Repowering old plants or constructing new plants in the South Coast, where the state's greatest demand is located, has been identified as particularly problematic due to the region's air quality constraints.

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[42] CEC, "2007 Integrated Energy Policy Report", CEC-100-2007-008-CMF.
[43] State Water Resources Control Board, proposed *Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling*, March 2008.

Along with reliable power plants, important components of a reliable electricity system are distribution, transmission, and availability of fuel supplies. Like power plants, distribution systems are aging, and require substantial infrastructure investments to ensure their continued reliability. The construction of new transmission lines is needed to increase the state's renewable electricity sources to meet the existing regulatory goals of 20 percent. If these goals are not met, the price of electricity could increase as utilities incur financial penalties. These issues have all been identified in the 2007 Integrated Energy Policy Report (2007 IEPR) as high priorities for the state in the near term.

A third challenge is from the effects of climate change such as increasing frequency and magnitude of extreme weather events. This could drastically affect the duration and magnitude of peak demands, increasing reliance on aging power plants. During the summer months, California also imports energy generated by hydropower from the Northwest to meet peak demand. Decreasing snowpack within California and throughout the west is likely to reduce the availability of this clean and relatively inexpensive hydropower source, further exacerbating the problem. In addition, a large number of power plants in California are located along the coast. The potential for sea level rise associated with climate change could impact the operation of those plants.

The 2020 business-as-usual greenhouse gas emissions forecast for the electric power sector is 139.2 $MMTCO_2E$. These emissions are the result of in-state power generation plus specified and unspecified imported power. BAU forecasted emissions assume that all growth in electricity demand by 2020 will be met by either unspecified imports or in-state natural gas-fired power plants.

The 2020 BAU forecast for emissions from specified sources of imported electricity (i.e., power received from specific out-of-state power plants) is assumed to decrease resulting from the closure of one coal-fired power plant (Mojave) previously supplying imported electricity. The demand previously served by the closed plant was replaced by in-state natural-gas generation. Based on outputs from the California Energy Commission's (CEC) electricity demand models, in-state electricity generation and specified imports would not meet the State's full electricity demand in 2020. The remaining demand is assumed to be met by unspecified imported electricity (i.e., power received from a mix of power generating sources outside the State).

The Emissions Performance Standard, (EPS) was established by SB 1368 (Perata, Chapter 598, Statutes of 2006), and will effectively reduce emissions from imported, coal-generated electricity. Regulations adopted pursuant to SB 1368 set by the CPUC for investor-owned utilities and by the CEC for publicly-owned utilities prevent all California utilities from entering into long-term contracts that fail to meet an emissions performance standard. As existing agreements expire, coal-intensive electric utilities will see reduced emissions that minimize their need for allowances under cap and trade. Such utilities will need to plan to replace coal-generated electricity with energy efficiency, renewables and less carbon-intensive resources. ARB does not consider the EPS in the forecasted 2020 emissions. This allows the Scoping Plan reductions from increasing renewable power generation to be counted against with the BAU forecasted 2020 emissions without double-counting the reductions.

Electricity and Natural Gas in Residential and Commercial Properties

The Commercial and Residential sector is expected to contribute 46.7 $MMTCO_2E$ or about eight percent of the total statewide greenhouse gas emissions in 2020. Forecasted BAU emissions from the Commercial sector include combustion emissions from natural gas and other fuels (e.g., diesel) used by office buildings and small businesses. Residential emissions result primarily from natural gas combustion used for space heating and for hot water heaters. Growth in emissions from the Commercial and Residential sector is due primarily to the expected increase in population and assumed increased use of natural gas. Emissions from the use of other fuels, such as diesel fuel, are assumed to remain relatively constant over time.

Population growth in California will continue to increase electricity demand. The extent of the increase depends on natural gas used and the location of the users.. Trends towards larger homes and increases in electronic equipment will also increase demand.

According to the Attorney General's website, during 2007 and 2008, an unprecedented number of communities across the state implemented environmentally sensitive, or "green" building requirements in order to increase energy efficiency and decrease greenhouse gas emissions and other environmental impacts within their jurisdictions. In the first half of 2008 alone, nearly a dozen mandatory green building ordinances have taken effect, requiring private developers to utilize and document green building practices used throughout the construction and life of the project. Other California cities, like San Francisco, San Leandro, Santa Rosa, Hayward and Los Altos Hills are currently developing ordinances for enactment in the near future. The experience of these cities has shown that bold, ambitious action to reduce carbon emissions is possible. These efforts have taken place without the Green Building measures being adopted as part of the Scoping Plan, and ARB applauds all the jurisdictions that are moving forward with adopting green building ordinances.

Water

California's water system is stressed today, and will likely be more so in 2020. The California Water Plan Update 2005 presents three potential scenarios for conditions in 2030. All three scenarios indicate a growing demand for water and increasing stresses on a complicated system. The Colorado, Delta, and Klamath water supply systems are experiencing serious conflicts among ecosystem, agricultural, and urban needs, and many infrastructure solutions under discussion today will likely not be in place by 2020.

All sectors will be affected by the changing dynamic in the amounts of water stored in the state's snowpack. Balancing the water needs of the state, the expected increase in water demand for energy production and industrial uses, consumption by an increasing population, increase in demand to grow crops all balanced with maintaining water quality and healthy ecosystems, will become more complex, challenging and expensive.

Water is intricately linked with energy and the state is already experiencing the need to conserve both water and electricity. In California, hydropower provides about 15 percent of the total electricity[44] while approximately 19 percent of the state's electrical demand comes from transporting, treating and using water. California's economy is built upon both reliable and affordable fuels and water. If the State does not implement the water measures identified in this

[44] http://www.energyquest.ca.gov/story/chapter12.html

Plan, the already over-allocated water system will face additional water shortages. Without actions to improve water supplies, water shortages could get worse at a rate of approximately two to three percent per year. This rate is likely to be much higher, given the likely impacts that global warming will have on the State's water system. These measures are needed, at a minimum, to meet increasing demand from a growing population.

Industry

The Industry Sector as defined in the Scoping Plan includes refineries, oil and gas facilities, cement and glass manufacturing, and industrial facilities that employ boilers or general combustion engines. The business-as-usual assumptions for refineries are discussed in the transportation section above. Activity in oil fields in southern California and gas fields in northern California are driven by price and availability, and could therefore expand in the future if current price trends continue. Off-shore drilling would most likely hold steady, due to the limited yield and potential for severe environmental impacts. While the demand for cement will grow with population growth, most of the demand is likely to be met through out of state production while the current rate of in-state production holds steady. Overall manufacturing is expected to slightly decline, while the commercial sector increases. Manufacturing will likely remain concentrated in the South Coast and Bay Area, with agricultural and food processing concentrated in the San Joaquin Valley.

Emissions for this sector are forecasted to grow to 100.5 $MMTCO_2E$ by 2020, an increase of approximately five percent from the average emissions level of 2002-2004. BAU-forecasted emissions for this sector are variable, but overall are not expected to grow substantially. Most of the growth from this sector comes from the fuel use and process emissions of three industries: cement plants, oil and gas production, and refining. Emissions from the combustion of natural gas are expected to grow for some industries (e.g., cement plants) and decline for others (e.g., food processors). These assumptions of growth and decline in natural gas demand are based on outputs from energy demand modeling conducted by CEC staff for the 2007 IEPR.

Recycling and Waste Management

Currently, California disposes of an estimated 42 million tons of waste in landfills each year, of which an estimated 30 percent is compostable organic materials, 22 percent is construction and demolition debris, and 21 percent is paper.[45] Fifty-four percent of California's waste is diverted from landfills and recycled or repurposed. Most of the remainder of California's waste is sent to landfills in the state. In the future, the need for new landfills will be determined by both population growth and by how well the State implements its waste management goals. The California Integrated Waste Management Board (CIWMB) has a strategic goal of becoming a Zero Waste State. One supporting goal is to halve the volume of organics going to landfills by 2020. These goals will require the development of new facilities to recycle and repurpose waste, but will also reduce the need for new landfill capacity.

Forests

The Forest sector is unique to California's GHG inventory because it combines both positive and negative emissions into a current sink of approximately -5 $MMTCO_2E$ (2002-2004 average). This net number is negative because the gross emission rate from fires, decomposition,

[45] From the California Integrated Waste Management Board website: http://www.ciwmb.ca.gov/Climate/ Organics/ default.htm.

harvesting, land conversion, and waste is less than the atmospheric uptake of carbon from forest growth. In addition to being a GHG sink, forests also provide multiple ecological benefits like habitat, structure, and nutrient cycling, as well as a suite of other human benefits or services such as water storage, soil stability, air and water quality, wood products, and recreation. The BAU inventory shows that forest sector emissions are increasing while forest growth is remaining the same. Two factors addressed in the Scoping Plan which affect forest sector emissions are land conversion and the incidence of wildfires. If this trend continues, emissions will equal uptake by about 2020 meaning that the inventory will increase to zero and this sink will be lost.

As seen in summer 2008, wildfires can significantly impact air quality and threaten public safety. Wildfires in water supply watersheds can also impact drinking water quality for years after they occur. Population growth will increase pressure to develop forest lands and development in close vicinity of forests can further increase risk. Global warming is also likely to increase risks associated with the Forest sector through changes to weather patterns which can impact forests both directly and indirectly, by creating hospitable conditions for pests and catastrophic fires.

High Global Warming Potential (High-GWP) Gases

Consumer demand, vehicle use patterns, and increased electrical demand due to population growth will increase the amount of high-GWP gases released to the atmosphere. The rates of increase vary by type of activity.

The forecasted BAU 2020 emissions of high-GWP gases are 46.9 MMTCO_2E. High-GWP gases, including sulfur hexafluoride (SF_6) from electric utility applications, substitutes for ozone depleting substances (ODS) (primarily hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)), and other high-GWP gases used in semiconductor manufacturing and other industrial processes are combined under one sector for purposes of the Scoping Plan. The forecast of business-as-usual emissions of high-GWP gases is derived from the United States Environmental Protection Agency (U.S. EPA) Vintaging Model, which outputs predicted annual consumption and emissions of all high-GWP gases based on end-use equipment, the amount of gas required for manufacture and maintenance, and disposal emissions. Emissions of HFCs and PFCs as ODS substitutes occur from their use in refrigeration and air conditioning systems, among other commercial and industrial applications. The high business-as-usual forecasted emissions in 2020 comes about as ODS's are rapidly replaced by substitutes, as more ODS's are phased out. In addition, ARB assumes that the effect of an expansion of the electrical transmission system infrastructure, combined with the technical improvements to the equipment in the system, will result in no net change in SF_6 emissions in 2020.

Agriculture

The agriculture sector includes emissions from livestock; i.e. digestive processes and manure management; combustion of liquid and gaseous fuels used for irrigation and crop production; emissions from fertilizer use and application of other soil additives; and emissions from agricultural residue burning. By 2020 there is significant potential for continued conversion of farmlands to urban, commercial or industrial development or other uses. The California Department of Food and Agriculture is currently developing a strategic plan for the future of agriculture in California.

Agricultural residue burning and livestock emissions were forecast using ARB's criteria pollutant forecasting approach. Forecasted emissions from the combustion of natural gas were

estimated using outputs from the 2007 IEPR developed by CEC. Other agriculture-related emissions were either held constant or extrapolated using historical trends to obtain a 2020 BAU estimate. BAU emissions from the agriculture sector are forecasted to increase about seven percent from current levels to 29.8 $MMTCO_2E$ in 2020, due exclusively to the assumed increase in livestock population.

In spite of current measures to preserve farmlands and open space, through Williamson Act contracts, State land purchase, and general plan land zoning, population increases will continue to pressure the conversion of farmlands to urban, commercial and industrial development.

3. POTENTIAL ENVIRONMENTAL BENEFITS OF CLIMATE CHANGE SCOPING PLAN

A. AIR RESOURCES

ARB and local air quality management districts (AQMD) and air pollution control districts (APCD) have a long tradition of successfully regulating stationary sources, vehicles, fuels, and consumer products to improve California's air quality. California's weather and topography combine to trap air pollutants that commonly result in poor air quality. Twenty counties in California fail to meet the health-based State ambient quality standard for ozone (smog) and eleven counties fail to meet the health standards for fine particulate matter. In addition, some California communities experience disproportionate impacts from poor air quality due to the proximity to a concentration of pollution sources. California's numerous air quality plans, programs, and regulations collectively provide the mechanisms to continually improve air quality.

Climate change can lead to changes in weather patterns that can influence the frequency of meteorological conditions conducive to the development of high pollutant concentrations. High temperatures, sunlight, and stable air masses tend to occur simultaneously and increase the formation of ozone and secondary organic carbon particles. Weather conditions associated with warmer temperatures increase smog. Thus, climate change effects are expected to exacerbate air quality problems in the future. This evaluation does not attempt to quantify the effects of climate change in 2020 nor evaluate Scoping Plan implementation in this context.

For the purposes of this section, criteria pollutant and toxic air contaminant emissions will often be referred to as "co-pollutants" since the focus of the Scoping Plan is greenhouse gas emissions. This section focuses on the potential impacts on co-pollutant emissions since the recommended measures are designed to reduce greenhouse gases.

Criteria Pollutants

Both the California and federal governments have adopted health-based standards for the criteria pollutants, which include ozone, particulate matter (PM10, PM2.5), carbon monoxide (CO), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).

Ozone, a colorless gas that is odorless at ambient levels, is the chief component of urban smog. Ozone is not directly emitted as a pollutant, but is formed in the atmosphere when hydrocarbon and NOx precursor emissions react in the presence of sunlight. Meteorology plays a major role in ozone formation. Generally, low wind speeds or stagnant air, coupled with warm temperatures and cloudless skies provide the optimum conditions for ozone formation. As a result, summer is generally the peak ozone season. Because of the reaction time involved, peak ozone concentrations often occur far downwind of the precursor emissions. Therefore, ozone is a regional pollutant that often impacts a large area. Inhalation of ozone can lead to inflammation and irritation of the tissues lining the body's airways, which can cause spasm and contraction, reducing the amount of air that can be inhaled. Ozone in sufficient doses can also increase the

permeability of lung cells, making them more susceptible to damage from environmental toxins and infection. Ozone exposure is associated with an increase in hospital admissions and emergency room visits, particularly for lung problems such as asthma and chronic obstructive pulmonary disease. The elderly, children, adolescents, and adults who exercise or work outdoors are most susceptible to adverse impacts from ozone exposure.

Particulate matter (PM) is a mixture of substances that includes elements such as carbon and metals; compounds such as nitrates, sulfates, and organic compounds; and complex mixtures such as diesel exhaust and soil. These substances may occur as solid particles or liquid droplets. Some particles are emitted directly into the atmosphere. Others, referred to as secondary particles, result from gases that are transformed into particles through physical and chemical processes in the atmosphere. Exposure to PM aggravates a number of respiratory illnesses and may even cause premature death in people with existing heart and lung disease. Both long-term and short-term exposure can have adverse health impacts. Particulate matter less than 2.5 microns in diameter (PM2.5) poses an increased health risk because it can deposit deep in the lung and contains substances that are particularly harmful to human health.

ARB and local air districts have regulated the sources of criteria pollutants – cars, trucks, consumer products and industrial sources – for decades. The State Implementation Plan (SIP) describes California's comprehensive plan for reducing emissions of ozone and fine particle precursors to meet the federal standards for healthful air. Table H-1 summarizes the Scoping Plan measures that are already being pursued as part of the 2007 revision to the SIP (2007 SIP), or that were already underway before the enactment of AB 32.

The 2007 SIP calls for significant reductions in emissions of nitrogen oxides (a precursor to both ozone and fine particles) and direct emissions of fine particles. As seen in Table H-2, the 2007 SIP is expected to reduce emissions of NOx by about 20 percent statewide from "business as usual" levels in 2020, and direct emissions of fine particles by almost 15 percent. Many control measures first identified in the Goods Movement Emission Reduction Plan (GMERP) are also included in the 2007 SIP.

Toxic Air Pollutants

A toxic air contaminant (TAC) is defined as an air pollutant which may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air. However, their high toxicity or health risk may pose a threat to public health even at very low concentrations. In general, for TACs, there is no concentration that does not present some risk. In other words, there is no threshold level below which adverse health impacts are not expected to occur. This contrasts with the criteria pollutants for which acceptable levels of exposure can be determined and for which the State and federal governments have set ambient air quality standards.

The majority of the estimated health risk from TACs can be attributed to a relatively small number of compounds, with the highest risk from PM from diesel-fueled engines (diesel PM, or PM2.5 from diesel sources). In addition to diesel PM, benzene and 1,3-butadiene are also significant contributors to overall ambient public health risk in California. The other seven TACs posing the greatest ambient risk are acetaldehyde, carbon tetrachloride, hexavalent

chromium, *para*-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene. Over the past ten years, ARB programs have reduced TAC emissions in the state by 50 percent.[46]

[46] http://www.arb.ca.gov/toxics/brochure.pdf

Table H-1: Scoping Plan Measures Included in 2007 SIP

Measure	In 2007 SIP	Not in 2007 SIP but underway before AB 32	Early Action Measure or New in DSP
California Cap-and-Trade Program Linked to Western Climate Initiative			X
Pavley I and Pavley II-Light-Duty Vehicle GHG Standards	X		X
Vehicle Efficiency Measures			X
Low Carbon Fuel Standard			X
Ship Electrification at Ports	X		
Goods Movement Efficiency Measures	X		X
Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency			X
Medium and Heavy-Duty Vehicle Hybridization			X
Regional Transportation-Related GHG Targets			X
High Speed Rail		X	
Energy Efficiency (Electricity)			X
Energy Efficiency (Natural Gas)			X
Solar Water Heating		X	
Million Solar Roofs		X	
Increase Combined Heat and Power			X
Renewables Portfolio Standard		X	X
Water Use Efficiency		X	
Water Recycling		X	
Water System Energy Efficiency			X
Reuse Urban Runoff			X
Increase Renewable Energy Production (from Water Sector)			X
Public Goods Charge (for Water)			X
Energy Efficiency and Co-Benefits Audits for Large Industrial Sources			X
Industry Sector Measures			X
Landfill Methane Control			X
Additional Reductions in Landfill Methane: Increase the Efficiency of Landfill Methane Capture			X
High Recycling/Zero Waste		X	
Sustainable Forest Target			X
High- GWP Measures			X
Methane Capture at Large Dairies		X	

Table H-2: Statewide Emission Reductions from Proposed New 2007 SIP Measures in 2020
(tons per day)

	Baseline Emissions	Reductions from 2007 SIP Measures	Emissions with 2007 SIP
NOx	2254	441	1813
PM2.5	247	34	213

Today, particulate matter from diesel represents 70 percent of the known risk from air toxics in California. The Diesel Risk Reduction Plan sets a goal of reducing the risk from diesel particulate matter 85 percent by 2020. ARB has adopted 24 airborne toxic control measures to control TAC emissions from mobile and stationary sources for both diesel and for the other TACs.

Evaluation Process

For measures that have already been adopted as regulations or have been analyzed in broader plans, the pertinent environmental analysis is summarized in this section. For other proposed measures, existing evaluations of similar activities were identified and explored to identify the types of potential impacts associated with the measure. ARB also developed statewide emission factors to establish a correlation between avoided combustion of fuels or production of electricity and emissions of NOx and PM2.5.

1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE

A cap-and-trade program would establish an enforceable limit (or cap) on total emissions for sources covered by the program. In the Scoping Plan, ARB recommends a cap-and-trade program under which emissions in 2020 from covered sources in the cap-and-trade program, plus expected emissions from uncapped (non cap-and-trade) sources, would be no greater than what was emitted in the aggregate in 1990. A key component of a cap-and-trade program is an allowance, which is a permit to emit greenhouse gases. As fewer allowances are issued over time, the cap declines. This proposed measure would cover about 85 percent of California's greenhouse gas emissions in 2020.

Under the recommendation, capped sectors would include electricity, transportation fuels, natural gas, and large industrial sources. The recommendation calls for a cap-and-trade program that would begin in 2012 with emissions declining through 2020. The total amount of greenhouse gas emissions from industrial sources and electricity generation would be capped beginning in 2012, and decline over time through 2020. Greenhouse gas emissions from commercial and residential fuel use (e.g., natural gas and propane) and transportation fuels would be capped after 2012, but no later than 2020.

The program would allow the limited use of surplus reductions from non-capped sources that are additional to reductions required by AB 32. These surplus reductions are called offsets. If permitted, offsets would be subject to stringent criteria and verification procedures to ensure their enforceability and consistency with AB 32 requirements.

Under the proposed measure, emissions and energy use from most of the sectors covered by a cap-and-trade program would also be governed by other regulatory measures and enforceable

policies, including performance standards, efficiency programs, and direct regulations. All measures that otherwise apply to capped sectors would contribute to achieving the cap by reducing their need to obtain allowances.

In the proposed cap-and-trade program, allowances would be allocated in an amount equal to the total emissions allowed in a compliance period. Each compliance period would run for a specific time period, such as one or three years. At the end of each such period, covered firms in the program would be required to surrender allowances equal to their total emissions for the compliance period. Allowances that are held by a covered source could be banked for future use if they are not needed to meet its compliance obligation. Alternatively, an unused allowance could be re-sold (traded) if the firm emits less than the number of allowances it holds.

This allowance value would reflect the average cost of reducing emissions; in other words, a firm would only go into the market to buy an allowance if the market value of the allowance is less than reducing emissions on site; alternatively, if a firm believes that selling its allowance in the market is worth more than banking the permit for future use, it would probably trade the allowance to another source at the current market price.

Failure of a facility to surrender sufficient allowances to cover its emissions would result in significant penalties. To maintain the environmental integrity of the system, non-compliance penalties would include purchasing and surrendering allowances at least equal to the facility's excess emissions.

ARB expects that the proposed cap and trade measure would provide air quality benefits. Because most greenhouse gas emission sources also emit criteria and toxic air pollutants, the proposed measure would generally result in overall air quality improvement. The recommended cap and trade program as well as other related measures applicable to capped sources would be designed to ensure that program implementation is consistent with State air quality plans and related statutory requirements.

Some individuals have expressed concerns about the potential for localized environmental impacts as a result of the trading component of the cap and trade program. This concern arises from the possibility that under a cap and trade program, a source of greenhouse gas emissions that impacts a community adversely impacted by criteria pollutants or TACs would not be required to reduce emissions. While the cap and trade program would not provide an incentive for a facility to increase emissions relative to BAU, it does allow a facility the option of obtaining allowances or offsets instead of reducing greenhouse gas emissions at their facility. While greenhouse gas emissions have no direct public health impacts, the processes involved in manufacturing and electricity generation from capped sources also emit criteria pollutants and toxic air contaminants. These pollutants can pose direct and adverse health effects on exposed populations.

California air pollution regulatory programs at the federal, state, and local level address individual source emissions from a regional and localized perspective. ARB evaluated the potential impacts of the recommendation on an example community – Wilmington – and found that the Scoping Plan would improve public health. The assessment is described in the Community Air-Quality Related Public Health Assessment in this Appendix. However, recognizing that this is only one example, if the Board chooses to pursue a cap-and-trade

program, during the regulatory development phase, staff will evaluate the program design to ensure that the program meets AB 32 requirements related to protection of public health as well as ARB's policies and actions for environmental justice (December 2001).[47] Local agencies, such as air pollution districts and planning commissions, could also impose more stringent requirements for sources of criteria pollutants and air toxics to address potential cumulative impacts.

2. TRANSPORTATION

Regulatory Background

The transportation sector includes personal transportation vehicles (like cars and trucks) as well as vehicles that transport goods (such as heavy trucks, ships, planes and trains). The transportation sector does not include off-road sources like bulldozers and forklifts, which are included in the industrial sector emissions inventory. Farm equipment, like tractors, is included in the agricultural sector emissions inventory. Emissions from recreational off-road equipment like all-terrain vehicles and recreational boats are relatively small, and their emissions are counted in the industrial sector. In 2006, on-road mobile sources[48] emitted the most NOx and ROG (ozone precursors) statewide. Exhaust emissions from mobile sources contributed only a very small portion of directly emitted PM2.5 emissions, but were a major source of the ROG and NOx that contribute to the secondary formation of PM2.5. ARB's control programs will continue to focus on meeting more stringent ozone and PM standards as well as reducing the risk associated with diesel particulate.

ARB has a long history of regulating passenger vehicles and other transportation sources to reduce emissions of criteria and toxic air pollutants. ARB has many regulatory programs in place to reduce criteria and toxic pollutant emissions – and in some cases GHG emissions – from transportation sources including:

The **Low-Emission Vehicle Program** (LEV and LEV II) has set standards to reduce emissions of NOx, ROG, non-methane organic gases (NMOG) and PM from passenger vehicles, light-duty trucks, and medium-duty vehicles. Pavley regulations to control tailpipe CO_2 and other associated GHG emissions are complementary to the LEV II program and both programs are implemented through the Low Emission Vehicle Regulations and Test Procedures.

The State's **Smog Check Program** ensures that passenger vehicle emission control systems are properly maintained throughout their useful life.

ARB's fuel programs require the use of gasoline and diesel fuel that burn more cleanly, reducing emissions of criteria and toxic air contaminants from the transportation sector, as well as off-road and stationary engines that use gasoline and diesel fuel. As the next phase of these fuel regulations, ARB is currently pursuing a low-carbon fuel standard that will reduce the carbon intensity of transportation fuel by at least 10 percent by 2020. The Board is scheduled to consider this regulation in 2009. Health and Safety Code §43830.8 requires that any new fuel undergo an environmental assessment of the fuel's potential impact on air,

[47] http://www.arb.ca.gov/ch/programs/ej/ejpolicies.pdf.
[48] 2008 Emissions Almanac.

water, soil, and as waste. The assessment must be peer reviewed, and any impacts minimized or mitigated.

The **Zero-Emission Vehicle Regulation** (ZEV), first adopted in 1990 and most recently modified in 2008, requires manufacturers to offer for sale in California an increasing number of hybrid, partial-zero, and zero emitting vehicles. Although the regulation focuses most directly on criteria pollutants, the emerging technologies encouraged by the regulation, such as battery electric, fuel cell and hybrid electric vehicles, also offer significant GHG benefits. Fuel cell, hydrogen, and electric vehicles are considered "zero emission vehicles" because they have either no exhaust or only water vapor. As a direct result of the ZEV program, over 750,000 Californians are currently driving vehicles that that receive partial-zero emission credit, conventional vehicles that achieve the most stringent emission tailpipe standards, zero evaporative emissions, and come with extended warranties. On March 27, 2008 ARB directed staff to look at incorporating climate change considerations into the program.

A complementary effort by the State is the **California Hydrogen Highway Network**, which is a public-private partnership to build the infrastructure for hydrogen vehicles and to add hydrogen vehicles into public transportation fleets. The current goal of this program is to have at least 50 hydrogen stations in the state and 2,000 hydrogen-powered vehicles by 2010, followed by a second and third phase of implementation. The program examines the well-to-wheel emissions of various hydrogen sources, and has adopted goals of a 30 percent reduction in greenhouse gas emissions; the use of at least 20 percent new renewable energy resources to produce the hydrogen; and no increase in toxic or smog-forming emissions relative to comparable gasoline vehicles.

The **Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles** (October 2000) calls for all new diesel-fueled vehicles and engines to use state-of-the-art catalyzed diesel particulate filters and very low-sulfur diesel fuel, and proposes retrofitting existing vehicles and engines where feasible. The plan sets a goal of reducing the 2000 risk from diesel PM from diesel-fueled engines and vehicles by 85 percent in 2020. To implement this Plan, ARB has adopted regulations to reduce toxic diesel risk from a wide range of in-use engines including those used in trash trucks, buses, public fleet vehicles, stationary engines, cargo handling equipment, transportation refrigeration units, and off-road equipment. ARB is scheduled to consider regulations to reduce diesel particulate emissions from in-use on-road trucks in 2008.

The **Emissions Reduction Plan for Goods Movement and Ports** (GMERP 2006) sets a goal of reducing the 2000 risk from diesel PM from goods movement and ports 85 percent by 2020. In order to accomplish this goal, the Plan identifies a number of measures to reduce diesel PM emissions from ships, harbor craft, off-road construction equipment, trucks, and rail. This Plan includes Ship Electrification at Ports, Ocean-Going Vessel Speed Reduction, and Port Drayage Truck regulations. ARB has already adopted a number of regulations to implement the GMERP including regulations on cargo handling equipment, drayage trucks, commercial harbor craft, and ocean-going ships.

(T-1) Pavley I and II-Light-Duty Vehicle GHG Standards 31.7 $MMTCO_2E$
Feebates - In-lieu of Pavley Regulations 31.7 $MMTCO_2E$

The Pavley I and II standards require reductions in tailpipe GHG emissions from passenger vehicles. The Pavley I regulations could affect the overall mix of fuels used by vehicles in 2020, by increasing the number of alternative fuel vehicles or low-emission vehicles. In the Initial Statement of Reasons for the regulation, ARB estimated criteria pollutant emission reductions of approximately 1.4 tons per day (TPD) NOx and 4.6 TPD ROG in 2020 due to reduced petroleum shipping, storage and distribution.[49]

The Pavley II measure is not yet defined well enough to quantify the potential to reduce air emissions; however it is also expected to reduce NOx, ROG, and PM2.5 emissions. Assuming Pavley II reductions are similar to Pavley I (reduced upstream emissions) they would reduce 0.2 TPD NOx, 0.7 TPD PM2.5, and 0.7 TPD ROG.

If the Pavley standards cannot be implemented they would be replaced by a Feebate program to achieve GHG reductions. The Feebate program would financially incent the transition from high-GHG emitting vehicles to low-GHG emitting vehicles by imposing a fee on the former and offering a rebate on the latter. Air emission effects from this measure will largely depend on the success of the incentive and the types of vehicles included. Under this measure, fuel would be more efficiently used and less fuel would be combusted statewide (essentially similar to an increase in average miles per gallon). Avoided fuel combustion would reduce NOx, PM2.5, and ROG.

(T-4) Vehicle Efficiency Measures 4.5 $MMTCO_2E$

Under this measure, tire inflation, tire tread programs and solar-reflective paints on vehicles are proposed to increase vehicle engine efficiency or reduce air conditioning use. This measure is estimated to reduce gasoline use by 507 million gallons in 2020, which could potentially result in the reduction of 0.8 TPD PM2.5 through avoided combustion. Since future engines would have to meet NOx standards, this measure would not result in new NOx emission reductions from the tailpipe. Similar to measure T-1, reductions of 0.2 TPD NOx and 0.8 TPD ROG could be achieved through upstream reductions in the transportation and refining of fuels.

Co-pollutant emissions from solar-reflective automotive paint and window glazing manufacturing and application are anticipated to be similar to existing paints and glazes, so there would be no change in associated emissions.

(T-2) Low Carbon Fuel Standard 15 $MMTCO_2E$

The Low Carbon Fuel Standard (LCFS) is currently undergoing regulatory development in parallel with the AB 32 Scoping Plan. The goal of LCFS is to reduce the carbon intensity – the amount of greenhouse gas emissions associated with the life cycle of the fuel – by 10 percent by 2020. It is anticipated that there will be a variety of options fuel producers can pursue to meet this standard, which makes the environmental impact of the LCFS a difficult measure to examine in the context of the Scoping Plan. A reduction in carbon intensity does not directly relate to a specific change in criteria pollutants or in fuel combustion. The LCFS regulatory proposal will contain a more detailed analysis of these fuel paths, their life-cycle GHG emissions and environmental impacts, and potential combinations of use for compliance. This section

[49] Final Statement of Reasons, Pavley I Regulations.

highlights the potential sources and types of air emissions associated with identified lower-carbon fuel types that may be pursued in the implementation of the LCFS. One goal of the LCFS is to maintain or reduce criteria pollutant or TAC emissions. Although ARB expects the LCFS will reduce criteria pollutants, to be conservative in this analysis we have assumed no change in criteria pollutants. The regulation will more fully document and quantify potential air resource impacts or benefits.

Low carbon fuels that may be used to comply with the LCFS include low carbon ethanol (sugarcane, switchgrass, waste residues, etc.), electricity, hydrogen, natural gas, and renewable biodiesel (from soybean, animal fat, recycled cooking oil, etc.). Potential fuel sources will be discussed in this evaluation, and potential fuel end uses (e.g. vehicles, energy plants) are discussed under relevant measures in other sectors.

The goal of the LCFS measure is to reduce the full life-cycle carbon content of transportation fuel, which will reduce net GHG emissions. Another goal of the LCFS is to maintain or reduce criteria pollutant emissions evaluated over the lifecycle of the fuel stock.

"**Biofuels**" is a general term used to describe various fuels produced from renewable sources. These include alcohol fuels, such as ethanol, various types of biodiesel and other fuels. Biofuels can be produced from food crops (e.g., sugarcane, corn, etc.), non-food crops (switchgrass, algae, etc.), vegetable oils (often used cooking oil), or other waste residues (often called biomass and include agricultural residues, municipal waste, forest trimmings, etc.). Biomass waste residue is expected to play a large role in the future due to its expected low-carbon intensity. Biofuels can be used to produce blends of conventional fuels (e.g. gasoline and ethanol or biodiesel and diesel) or can be used as essentially 100 percent biofuels. In addition, some processes are designed to produce biofuels that can be used to directly replace conventional fuels.

The air emissions associated with each of these sources can vary considerably. Some factors that affect the air emissions are described below.

- **Recycling of waste materials** to produce biofuels does not typically create a new emission source, and is environmentally preferable to traditional disposal. There are emissions associated with truck trips for collecting these materials, but they most likely do not result in a net increase in co-pollutant or greenhouse gas emissions as they would replace disposal-related truck trips.

- **Food crop production** for biofuels may create new emission sources for acquiring the feedstock. This would not occur if there is merely a redirection of existing food production to fuel production. Land use conversion is discussed in the Land Resources section of this evaluation. Critical factors in determining air emissions include where the feedstock is produced (which will impact both the resources needed for production, as well as rail and other transportation-related emissions), whether the biofuel crop is replacing another type of crop (and the difference in air emissions associated with the two crops), and whether the crop is competing with food crops for land. Crop production requires the use of off-road equipment, application of fertilizer and pesticides, and irrigation water. Air emissions from fertilizers and pesticides as well as run-off into streams, rivers and lakes result from traditional agricultural practices. Each of the biofuel production approaches mentioned above has associated air emissions. There are NOx, volatile organic compounds (VOCs),

and PM emissions associated with agriculture, as well as emissions associated with truck trips to transport raw materials to intermediate processing facilities.

- **Non-food crop production** for biofuel production (energy crops) uses plants that are less resource-intensive (requiring less fertilizer and water consumption), and thus have lower associated air pollutant emissions. The associated truck trip emissions would be expected to be similar to truck trip emissions from food crop production.

- **Algae** are a relatively newly identified source of biofuels and not yet fully studied. Early research shows that algae grow faster, contain significantly more energy per mass than other identified crop types, do not require the use of crop or valuable habitat lands, do not necessarily require fresh water (brackish and some wastewater can be used), and can consume waste CO_2 from refineries or power plants.

There are numerous current and proposed biofuel plants within California: Figure H-1 displays the mixture of biodiesel and ethanol facilities, while Figure H-2 displays the feedstocks these facilities are using or propose to use.

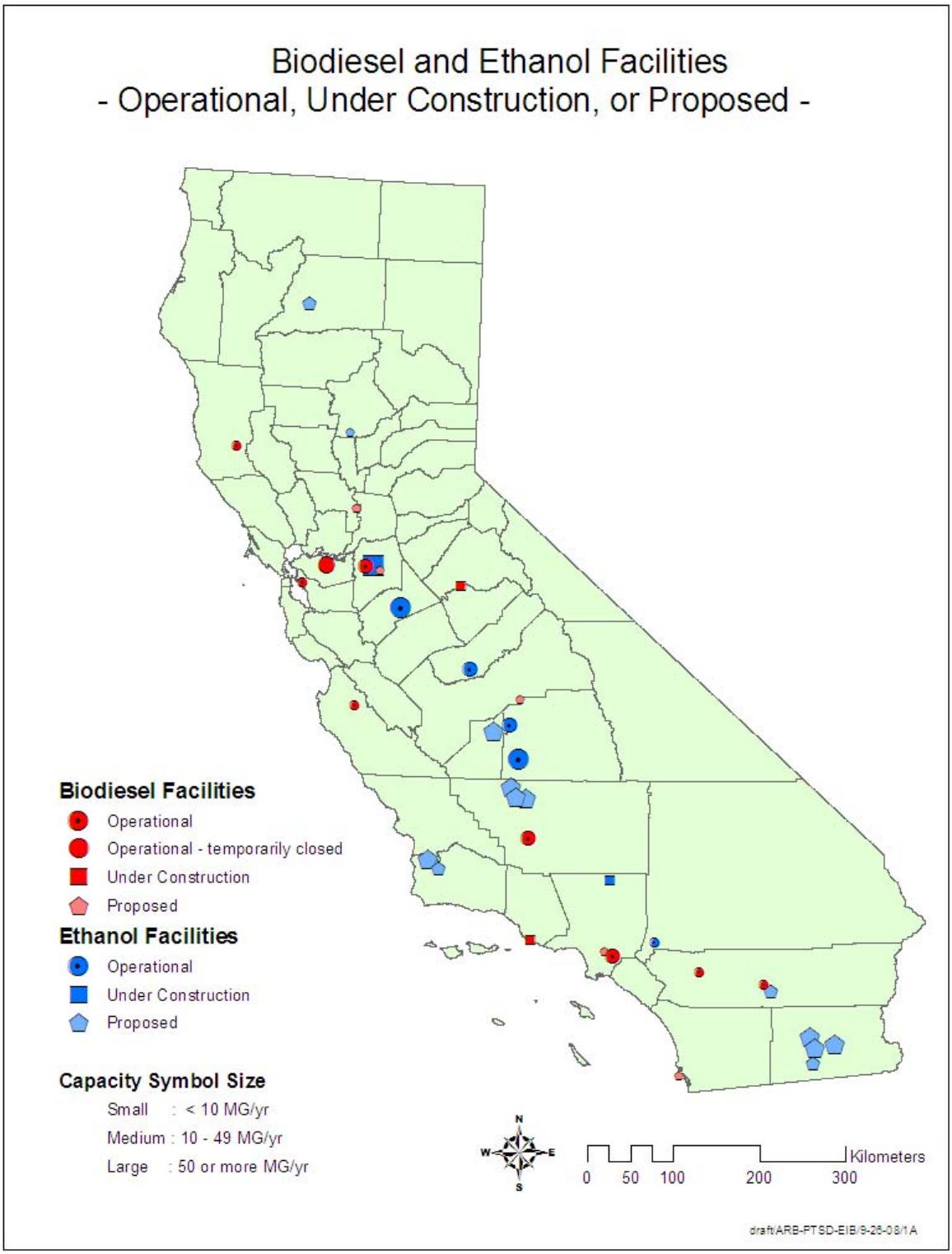
Note that projections of fuel production will likely change since the use of biofuels (biodiesel and ethanol) will be partially driven by recent federal legislation[50] directing fuel producers to increase their use of renewable fuels and mandating amounts of advanced biofuels, including those derived from cellulosic and biomass resources.

Biodiesel: ARB estimates that 675 million gallons (MG) of biodiesel could be needed per year to meet the 2020 LCFS demand. In addition to the 72 MG per year[51] already built or planned, California could produce between 125 to 500 MG per year of biodiesel from waste oils and fats and 100 to 200 MG per year of biodiesel from soybean oil.[52, 53] Regulatory measures could require maximizing the use of waste materials for biodiesel production. Rather than dictate which specific fuels should be used, the LCFS will release life cycle carbon intensity values for all available fuels. Fuel suppliers will use that information to decide how best to meet regulatory carbon limits. Waste materials would be expected to have lower carbon intensity than virgin materials. Several biodiesel plants are already under construction or planned for construction in California, using waste oils, waste grease, animal fats and some soybean oil. Additional demand could be met through construction of plants using other feedstocks, such as soybean oil, and through importation of biodiesel from outside the state.

Biodiesel production plants tend to be located close to their feedstocks and secondarily close to rail yards or freeways for distribution to retail sites. Methane emissions are associated with the biodiesel production process, which can be reduced by an estimated 90 percent through a condensation/recovery process. Other emissions are related to the energy source and demand of

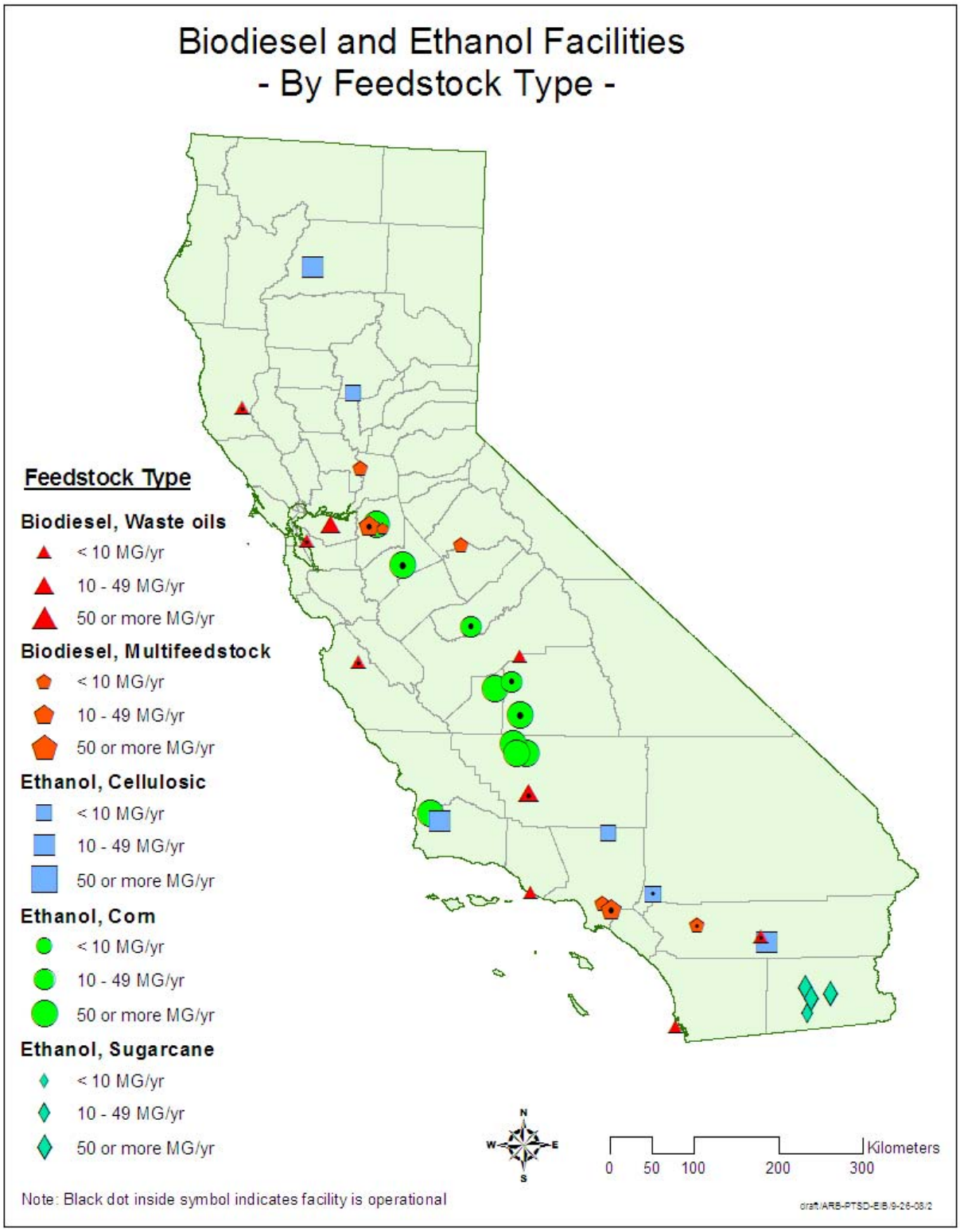
[50] The Federal Energy Independence and Security Act of 2007.
[51] Estimate based on CEC Staff Report in review (Yowell, 2007) and on the Crimson Renewable Energy Plant under development in Bakersfield (30 MG).
[52] Presentation at ARB Workshop, May 9, 2008.
[53] *Compliance Pathways for Meeting the Low Carbon Fuel Standard in California. Part I. Biofuel Supply Curves,* Nathan Parker et.al.; Western Governors' Association Report, *Transportation Fuels for the Future. Biofuels: Part II*, January 8, 2008.

Figure H-1: Location and Size of Known and Proposed Biodiesel and Ethanol Facilities[54]



[54] Based on ARB staff research.

Figure H-2: Feedstocks of Known and Proposed Biodiesel and Ethanol Facilities[55]



[55] Based on ARB staff research.

the plant. Production of biodiesel locally to meet California's projected needs could result in a net reduction in emissions associated with the truck and rail traffic generated by importing biodiesel from the Midwest.

Ethanol: The CEC estimates that by 2020, California will have a demand for 1.6 billion gallons of ethanol per year,[56] and that this demand will continue to grow beyond 2020. ARB estimates that California could meet this demand through production of up to 1 billion gallons per year of ethanol from waste products (municipal solid waste, forest residue, agricultural residues), and 600 million gallons per year of ethanol from corn.[57] As an example, this demand could be met through approximately 50 production plants, each producing around 50 MG per year.

Ethanol facilities tend to be located near rail or truck terminals. Siting may also consider proximity to the feedstocks or the users of ethanol co-products. For example, one of the largest ethanol production facilities currently permitted in California is located in a rural agricultural area close to users of their distilled grain by-product. The facility does not employ co-generation, so it burns natural gas to produce the steam needed to produce ethanol, and purchases electricity from the utility. The steam production is the primary source of NOx emissions, the largest sources of PM10 are associated with grain handling, and the largest sources of VOC emissions are associated with the fermentation, distillation, storage, and loading of the ethanol produced. Because VOC emissions from this facility triggered offset requirements, emissions above the trigger level of 20,000 lbs/yr were mitigated by procuring VOC emissions offsets. Emissions of NOx, CO, PM10, and SOx did not trigger offset requirements. Emission control technologies employed by this facility include ultra-low NOx burners on steam boilers, baghouses for PM control, and wet scrubbers to control VOC emissions. This 40 MG per year facility, as permitted, could emit up to 0.02 TPD of NOx, 0.07 TPD CO, 0.05 TPD VOC, 0.04 TPD PM10 and 0.005 TPD SOx.

The LCFS regulation will consider the impacts of the life cycle of each fuel path. For ethanol air pollutant emissions, this would also include indirect emissions associated with the transportation of the product and feedstock by truck and/or rail.

Hydrogen: Depending upon how it is produced, hydrogen can be a low carbon fuel. As a transportation fuel, hydrogen can be used in either modified internal combustion engines or in fuel cells. Unlike the burning of carbon-based fuels which produces CO_2, CO, NOx, VOC and PM and other potentially toxic compounds, combusting hydrogen produces heat, water, and some oxides of nitrogen. Hydrogen-fueled fuel cell vehicles only produce heat and water vapor.

Like other fuels, hydrogen must be examined over the entire process chain, including the energy needed to produce the fuel as well to compress or cool the hydrogen for storage. Potential hydrogen production methods include electrolysis of water, steam reformation of natural gas, biomass gasification and coal gasification. Today, the two most common ways to produce hydrogen are steam reformation of natural gas and electrolysis of water. Hydrogen produced using electricity generated from renewable resources and used to power fuel cell vehicles results in extremely low air emissions. Senate Bill 1505 (2006) directs ARB to develop environmental

[56] California Energy Commission estimate, presented at May 9, 2008 ARB Workshop: *Compliance Pathways for Meeting the Low Carbon Fuel Standard in California, Part I. Biofuel Supply Curves*.
[57] Ibid.

regulations for the production of hydrogen for transportation use, a process that started in late 2007.

Electricity: Increasing the number of electric vehicles and plug-in hybrids would substantially lower the carbon-intensity of transportation fuels. The co-pollutant emissions associated with electricity as a transportation fuel are expected to be the same as the co-pollutant emissions associated with electricity overall and are discussed in the Energy section. Off-peak loads would increase significantly as grid-rechargeable electric vehicle penetration increases. This increased load would produce some increase in GHGs and co-pollutants from base load power plants. Little to no increase in ozone would occur, since the increased load would occur between the late evening and the early morning. All such increases in emissions would be more than offset, however, by the displacement of internal combustion vehicles.

(T-5) Ship Electrification at Ports 0.2 MMTCO_2E
(T-6) Goods Movement Efficiency Measures 3.5 MMTCO_2E

The goods movement efficiency measures propose to reduce GHG emissions. The recommended goods movement measures in the Scoping Plan include regulations identified through the Goods Movement Action Plan and GMERP, as well as new measures for additional GHG emission reductions.

The GMERP prioritized implementation of air emission reductions based on health risk assessments, which identified how each port source category contributed to risk. The already adopted Goods Movement Sector regulations will reduce criteria and toxic air pollutants. For instance, ARB recently passed a series of regulations to reduce emissions of diesel PM, SOx, and NOx from ocean-going vessels, cargo handling equipment, transport refrigeration units, port drayage trucks, and commercial harbor craft. Also, new engine standards have been adopted by U.S. EPA for U.S. ships, off-road equipment, on-road trucks, harbor craft and locomotives. As these fleets turn over, we expect to see emissions reductions in criteria pollutant emissions and in some cases GHG emissions, as the vehicles and equipment become more fuel efficient.

California has also taken steps to reduce emissions from locomotives, entering into a Memorandum of Understanding (MOU) in 2005 with Union Pacific Railroad Company and BNSF Railway Company to reduce diesel PM. The MOU identifies actions including: reducing motor idling, accelerating the use of low sulfur diesel, reducing visible emissions, and conducting Health Risk Assessments for rail yards. Combined, these measures are expected to continue to reduce criteria and toxic air pollutant emissions from goods movement sources in the future, improving air quality and public health both in localized areas near goods movement sources and regionally.

The following section describes existing efforts to reduce emissions from goods movement activities as contained in the GMERP, as well as a new measure to improve the efficiency, and lower the GHG emissions, of goods movement activities in California.

Ship Electrification at Ports (Measure T-5): The GMERP establishes a goal of utilizing shore power for 20 percent of the ship visits to California ports by 2010, 60 percent of visits by 2015, and 80 percent of visits by 2020. ARB has already adopted a regulation to require ship electrification at ports and another is under development to further reduce at-berth emissions. Ships include container ships, passenger ships, refrigerated cargo ships, bulk ships, tankers, and

vehicle carriers. Over 2000 ocean-going vessels call at major California ports like the Ports of Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme each year. By 2020, hotelling of these ships are projected to emit 37 TPD NOx and 0.67 TPD PM without regulations; ship electrification will reduce these emissions by 9.6 TPD NOx and 0.6 TPD PM2.5. Although the Ship Electrification regulation was adopted primarily to reduce emissions of air toxics, it also provides GHG emissions reductions and is a discrete early action under AB 32.

Ocean-going Vessel Speed Reduction: The ocean-going vessel speed reduction (VSR) measure builds upon a voluntary program at the Ports of Los Angeles and Long Beach. This existing voluntary program contributes to implementation of the 1994 Ozone State Implementation Plan to reduce NOx in the South Coast Air Basin. Preliminary estimates from the Port of Los Angeles indicate this measure can reduce emissions from this source by 37 percent for NOx (3 TPD), 49 percent for SOx (2 TPD), and 49 percent for diesel PM (0.3 TPD). ARB will be assessing the results of the program to evaluate potential application to other areas and to estimate the statewide potential for reductions in emissions of NOx, SOx, diesel PM, and CO_2.

Clean (Green) Ships: Under this measure, a variety of strategies and technologies will be investigated to reduce fuel consumption and associated CO_2 emissions from ships. In part, it is expected that reductions of NOx will occur based on the penetration rates of Selective Catalytic Reduction technologies on new and existing ships.

Port Drayage Trucks: The adopted Port Drayage Truck Regulation[58] is expected to reduce NOx, PM10 and CO_2, by either accelerating the fleet's turnover to higher standard trucks or retrofitting existing trucks. Drayage trucks are on-road, diesel-fueled, heavy-duty trucks that transport containers, bulk, and break-bulk goods to and from the ports and intermodal rail yards and many other locations. ARB estimates that there are approximately 100,000 drayage trucks statewide, of which approximately 20,000 frequently service the ports and rail yards. This segment of the drayage fleet consists largely of independent owner/operators and ARB estimates that approximately 80 percent of such drayage trucks are operator owned. ARB estimates that drayage trucks emit an estimated 2.3 TPD diesel PM and 48 TPD NOx while moving goods to and from California's ports and intermodal rail yards.[59] Under the regulation adopted in 2007, regulatory compliance has two phases. By 2009, all pre-1994 truck engines must be retired or replaced with 1994 or newer engines. In addition, all 1994-2003 model year engines must achieve an 85 percent PM emission reduction through the use of an ARB-approved level 3 verified diesel emission control strategy. ARB estimates a statewide diesel PM emissions reduction of approximately 2.0 TPD PM2.5. In the second phase, drayage trucks would need to comply with the 2007 heavy-duty diesel-fueled on-road emission standards by 2014, which would reduce NOx emissions by approximately 33 TPD.

Commercial Harbor Craft: This measure would develop best management practices and outreach to encourage regular maintenance, vessel speed reduction, and other operational and maintenance practices to improve efficiency of commercial harbor craft. Air emission

[58] Regulation to Control Emissions from In-Use On-Road Diesel –Fueled Heavy Duty Drayage Trucks, adopted December 7, 2007.
[59] Drayage Truck Fact Sheet, http://www.arb.ca.gov/msprog/onroad/porttruck/drayagetruckfactsheet.pdf.

reductions have not been quantified.

Cargo Handling Equipment: Reducing the idling times of diesel-powered equipment could potentially reduce associated criteria pollutants. A future study of idling occurrences and emissions will determine the potential for air emission reductions.

Transport Refrigeration Units: Transport Refrigeration Units (TRUs) are refrigeration systems powered by diesel internal combustion engines designed to refrigerate or heat perishable products that are transported in various containers, including semi-trailers, truck vans, shipping containers, and rail cars. ARB adopted an Airborne Toxic Control Measure (ATCM) regulation to reduce emissions from in-use TRUs in 2004. ARB is now evaluating the feasibility of regulations to further reduce air toxic emissions from TRUs on trucks, shipping containers, and railcars by eliminating extended cold storage practice at distribution facilities, grocery stores, and other facilities where TRUs operate. This measure could reduce diesel fuel use by approximately 1.7 MG per year starting in 2011, reducing PM2.5 emissions by 0.1 TPD in 2020.

Rail: Other than addressing rail through the Goods Movement Efficiency Measures, the Scoping Plan does not recommend any specific measures for rail. Rail does play a critical role in goods movement, and reducing emissions from locomotives is a focus of ARB's efforts to improve public health in California. As fuel prices increase, increased demand for transport may be met through rail more than trucks, because rail can be up to four times more fuel efficient than trucks. ARB has worked with the federal government and railroads to reduce the criteria pollutants and air toxics associated with locomotives through fuel regulations, idling reduction requirements, increased fuel efficiency and pollutant control technologies. There are no direct effects from rail due to the Scoping Plan.

Goods Movement Efficiency Improvements: The GMERP and Goods Movement Action Plan identify the opportunity to improve the efficiency of goods movement activities, including more efficient engines and vehicles and through tracking and better scheduling of activities. The proposed measure in the Scoping Plan would identify and implement strategies to improve goods movement efficiency within the four key goods movement corridors in California in excess of the measures already contained in the GMERP. The measure would take advantage of available low carbon technologies and operational improvements to improve efficiency at the equipment/vehicle level, at goods movement facilities such as ports and intermodal railyards, and within the goods movement network within each trade corridor. Because in most cases, improvements in efficiency would result in decreased fossil fuel usage, air emission reductions are expected. If these measures reduce GHGs by 3.5 $MMTCO_2E$ through fuel efficiency and through some electrification of internal combustion engines, the emission reductions that could occur within California are approximately 16.9 TPD of NOx and 0.6 TPD PM2.5.[60]

[60] This estimate was made using an emission factor for heavy-duty vehicles (conservative for the goods movement inventory categories) and assuming 50 percent of emission reductions occur outside of California land boundaries.

(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency 0.93 MMTCO_2E

This measure recommends improving the aerodynamic efficiency of heavy-duty trucks to reduce GHG emissions, an efficiency that is estimated to reduce NOx emissions by 1.5 TPD.

(T-8) Medium and Heavy-Duty Vehicle Hybridization 0.5 MMTCO_2E

This measure recommends hybridization of medium and heavy-duty trucks that make frequent stops and starts, reducing diesel combustion by 500,000 gallons per day and reducing tailpipe criteria pollutants by 4.07 TPD NOx and 0.17 TPD PM2.5.

(T-3) Regional Transportation-Related Greenhouse Gas Targets 5 MMTCO_2E

Under this measure, ARB would work with metropolitan planning organizations (MPOs) to establish passenger vehicle GHG emission reduction targets (regional targets). It is important to achieve significant greenhouse gas reductions from changed land use patterns and improved transportation to help achieve the goals of AB 32. The specific air quality impacts of particular land use and transportation strategies applied to implement this measure would be evaluated under existing applicable regulatory structures as they are triggered, including CEQA. Generally, however, this measure would result in vehicle use reduction, which has the potential to improve air quality. If VMT were reduced four percent statewide by 2020 (approximately corresponding to reductions of 5 MMT CO_2E), associated criteria pollutants are estimated to decrease by 8.7 TPD of NOx, 12.9 TPD of ROG and 1.4 TPD of PM2.5.

(T-9) High Speed Rail 1 MMTCO_2E

The Scoping Plan supports the implementation of a high speed rail system. The recommended High Speed Rail (HSR) program has undergone environmental review under CEQA and National Environment Policy Act (NEPA) (http://www.cahighspeedrail.ca.gov/). ARB reviewed this documentation for its air emissions analysis. The programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS) examined the potential impacts of HSR on existing air quality. Regional pollutant burdens were calculated for each alternative, considering highway VMT, number of plane operations, number of train movements, and electrical power requirements for the recommended HSR system. Localized air quality impacts were also evaluated. In 2020, the air emission reductions based on the avoided fuel consumption of 18.7 million annual passenger trips in light duty vehicles would be 1.1 TPD NOx and 0.2 TPD PM2.5. If HSR uses natural gas-based electricity, it would increase emissions by 0.2 TPD NOx and 0.1 TPD PM2.5. HSR has informed ARB that it may seek renewable power supplies, which would eliminate the emissions associated with its electrical demand.

Summary of Co-Pollutant Emissions

Table H-3 presents the estimated co-pollutant benefits from the recommended measures in the Transportation sector. Recommended Pavley (T-1) and Goods Movement measures (T-5 and T-6) have been quantified within existing regulations and within the SIP, and are therefore included in the BAU scenario, and separated appropriately.

Table H-3: Estimated Statewide Co-Pollutant Emission Changes from Transportation Sector Measures in Scoping Plan
(tons per day in 2020)

Measure	Included in 2007 SIP or GMERP		Additional to 2007 SIP and GMERP	
	NOx	PM 2.5	NOx	PM 2.5
(T-1) Pavley I and II – Light-Duty Vehicle GHG Standards	-0.2	-0.5	-1.4	-0.6
(T-4) Vehicle Efficiency Measures			-0.2	-0.8
(T-2) Low Carbon Fuel Standard			0	0
(T-5) Ship Electrification at Ports	-9.6	-0.6		
(T-6) Goods Movement Efficiency Measures			-16.9	-0.6
Ocean Going Vessel Speed Reduction	-18.9	-1.6		
Clean (Green) Ships	-74	-0.8		
Port Drayage Trucks	-33	-2.0		
Commercial Harbor Craft	--	--	--	--
Cargo Handling Equipment	--	--	--	--
Transport Refrigeration Unit		-0.1		
(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency			-1.5	-0
(T-8) Medium and Heavy-Duty Vehicle Hybridization			-4.1	-0.2
(T-3) Regional Transportation-Related GHG Targets			-8.7	-1.4
(T-9) High Speed Rail[a]			-0.9	0.
Transportation Sector Total: [b]	**-135.7**	**-5.6**	**-33.7**	**-3.5**

[a] High Speed Rail emission reductions were not included in the public health analysis, due to difficulty in proportioning among air basins.
[b] Numbers may not add up as presented due to rounding.

3. ELECTRICITY AND NATURAL GAS

Regulatory Background

The air emissions of all stationary sources in California are regulated. For power plants or energy facilities, the **CEC Certification process** serves as an equivalent to the otherwise required state and local permitting requirements. The CEC has authority to certify (permit) the construction and operation of thermal electric power plants 50 megawatts or larger and all related facilities. The site certification process provides a review and analysis of all aspects of a proposed project, including public health and environmental impacts, safety, efficiency, and reliability, equivalent to the CEQA process. The process is also a public process. Smaller facilities with no potentially significant environmental impacts can apply for an exemption process, similar to a mitigated negative declaration approach under CEQA.

The CEC works with power plant proponents and local APCDs or AQMDs to complete a functionally equivalent permitting process. CEC prepares the necessary evaluation in a "Preliminary Staff Assessment", working with the local AQMD to ensure it provides the

information needed for the AQMD to approve the project. The final site certification from the CEC serves as its air quality permit, compliant with New Source Review requirements,[61] and including monitoring, reporting, and inspection requirements.

(E-1) Energy Efficiency (Electricity) 15.2 $MMTCO_2E$
(CR-1) Energy Efficiency (Natural Gas) 4.3 $MMTCO_2E$

Activities recommended under these measures would affect air quality by reducing the overall demand for electrical generation and the overall combustion of natural gas in California's residential and commercial sectors. California's appliance standards improve the operation and efficiency of refrigerators, freezers, air conditioners, and other appliances. All of the technologies utilized to implement the recommended energy efficiency standards are considered "off the shelf" in that they are readily available in the marketplace.

Efficiency and conservation measures that reduce peak demand are the most likely to reduce air emissions, as aging, less efficient plants are more likely to be operated when demand is high.

Measure E-1 recommends reducing electricity demand by 32,000 gigawatt-hours (GWh). Translating these reductions into the avoided operation (or possibly construction) electrical grid natural gas power plants,[62] ARB estimates that Measure E-1 would reduce statewide NOx by 7.0 TPD and statewide PM2.5 by 4.0 TPD in 2020.

Measure CR-1 recommends reducing residential and commercial natural gas combustion for heating by 800 million therms. The avoided air emissions associated with Measure CR-1 are 10.4 TPD of NOx statewide and 0.8 TPD of PM2.5 statewide in 2020, assuming emissions from residential and commercial natural gas units are similar in 2020 to today's emission rates.[63]

(CR-2) Solar Water Heating 0.1 $MMTCO_2E$

This measure recommends an alternative, zero-emission way to heat residential water that works with traditional water heating to replace a portion of the natural gas that would normally be burned. The recommended measure would replace an estimated 26 million therms of residential natural gas use each year. The avoided air emissions associated with the recommended measure is 0.3 TPD of NOx and 0.03 TPD of PM2.5 statewide in 2020.

(E-4) Million Solar Roofs 2.1 $MMTCO_2E$

This measure is an existing program that predates AB 32 and the Scoping Plan. Translating the recommended measure's avoided electricity into the avoided operation (or possibly construction) of electrical grid natural gas power plants,[64] equates to 1.0 TPD of NOx and 0.6 TPD of PM2.5 statewide in 2020.

[61] New Source Review requirements are discussed in greater detail in the Regulatory Framework for Stationary Sources at the end of this Appendix.
[62] Co-pollutant emission factors for electric grid natural gas power plants were developed using the state inventory of these sources projected out to 2020 with existing district control measures.
[63] Co-pollutant emission factors for commercial and residential natural gas combustion were developed using recent (1997 and 2000) methodologies and inventories of these sources with existing district control measures.
[64] Co-pollutant emission factors for electric grid natural gas power plants were developed using the state inventory of these sources projected out to 2020 with existing district control measures.

(E-2) Increase Combined Heat and Power 6.7 MMTCO$_2$E

Combustion-based power plants do not convert all of their available energy into electricity and typically lose more than half of the energy as excess heat. At the same time, there are many industrial facilities that require both electricity and heat which currently purchase electricity from the grid and burn natural gas in industrial boilers to generate thermal energy (heat). Combined heat and power (CHP) systems generate both electricity and thermal energy on site. When the systems are optimally sized to either meet the heat load of the industrial facility or provide the maximum amount of electricity that the facility could use during peak demand, excess electricity is produced that could be distributed to other electricity users. Combined heat and power is a more efficient use of the energy contained in fuel, and can also reduce the need to develop new or expand existing power plants.

Combined heat and power systems would be developed to improve energy efficiency in situations that also result in net reductions of GHG and co-pollutant emissions. While existing AQMD/APCD regulations on CHP systems and industrial boilers limit co-pollutant emissions, they do not necessarily evaluate the net change in emissions between CHP systems and the grid electricity they replace. Installation of CHP systems has the potential to affect local air emissions and should be examined for this potential at a project level.

Nearly all CHP systems are currently regulated by AQMDs and APCDs. A combined heat and power system can be fueled with natural gas or with renewable fuels. Co-pollutant emissions may vary by fuel type, similar to the discussion under measure E-2. ARB estimates that increasing the use of combined heat and power systems by 4,000 MW has the potential to reduce statewide natural gas combustion by 2.1 billion therms.[65] Assuming that on-site boiler use is reduced when cost-effective CHP systems are installed and that CHP systems are optimized for thermal load, the net change in co-pollutants due to the shift from industrial boiler to CHPs would be reductions of 2.0 TPD of NOx and 0.7 TPD of VOCs and increases of 0.6 TPD PM2.5 and 0.1 TPD SOx.

Using CHP systems to displace grid electricity also reduces co-pollutant emissions. Translating these reductions into the avoided operation (or possible construction) of electrical grid natural gas power plants, they would equate to 6.5 TPD of NOx and 3.7 TPD of PM2.5 statewide in 2020.

(E-3) Renewables Portfolio Standard 21.3 MMTCO$_2$E

This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. Currently, California's energy profile includes 12 percent renewable sources. This requirement could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons the benefits and impacts of each renewable resources are evaluated relative to electrical grid natural gas power plants, and are not individually quantified for potential air emissions.

There are air quality impacts associated with the construction of facilities to harness renewable resources– primarily from fugitive dust and diesel particulates from operation of construction

[65] For reference, a *therm* is equal to 100,000 British thermal units (*BTUs).*

equipment. These are assumed to be similar in nature to the construction-related emissions from natural gas-powered power plants, although the location and size of facilities can affect the magnitude and duration of these impacts. These impacts could be significant but would be temporary and would also most likely employ best management practices to minimize dust. ARB's implementation of the Diesel Risk Reduction Plan began reducing diesel particulates from construction equipment in 2002.

The remainder of this section focuses on the operation and maintenance of renewable resource facilities.

Wind energy is harnessed through large turbines. Wind power operation does not have any associated air emissions.

There are two major types of **solar** energy. The first concentrates the heat in sunlight using mirrors or lenses. This concentrated heat can be converted to electricity in a process similar to that used in a power plant. The second uses photovoltaic (PV) panels. When sunlight hits the PV cells, it is converted directly to electricity. Solar power does not have any associated air emissions from its operation.

Biomass energy is harnessed through the combustion of organic waste materials, residuals or agricultural products. Air emissions from biomass sources depend on the fuel type. These are also indirect emissions associated with the production, transportation, and/or disposal of the fuel source. Indirect emissions (from trucks and/or rail) are discussed in the Transportation section above (Measure T-2). The life cycle of biomass includes the sequestration of carbon within the biomass and the avoided carbon emissions from alternative methods of disposal. The trade-offs between energy production and the alternative methods of disposal are the primary source of potential environmental benefits.

Biomass (forest or agricultural residuals) or **municipal solid waste** (MSW) may be pre-processed and then combusted to produce steam to generate electricity. Biomass combustion must be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as biomass combustion generates 17 times the amount of NOx and 27 times the amount of PM as electrical grid natural gas power plants (per MWh).[66] MSW combustion must also be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as MSW combustion generates 24 times the amount of NOx and 5 times the amount of PM as electrical grid natural gas power plants (per megawatt-hour (MWh)). In some areas of the state, agricultural residuals are burned in open fires as a means of disposal. If the residuals used in a biomass plant would otherwise have been disposed of in open fires, burning the residuals in a biomass plant would reduce the air emissions while also producing electricity. All of these emissions can be minimized with modern control technologies or through good plant design.

The **anaerobic digestion** of human, animal, or wet organic wastes produces a gas of 50 to 80 percent methane. This "biogas" can be combusted to produce electricity. Anaerobic digesters must also be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as digester gas-based electricity generation generates 22 times the amount of NOx and 9 times the

[66] Estimates are based on renewable power generation emission factors developed from ARB surveys and emission inventories in 2000-2001, conducted during the California electricity crisis.

amount of PM as electrical grid natural gas power plants (per MWh). All of these emissions can be minimized with modern control technologies or through good plant design.

Combustion of **landfill gases** (mostly methane) to produce electricity puts methane to use that would otherwise be flared to control the methane emissions. Combustion is also used to reduce the toxic air contaminants associated with some landfills. Combustion of landfill gases must be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as its combustion generates 27 times the amount of NOx and 7 times the amount of PM as electrical grid natural gas power plants (per MWh). All of these emissions can be minimized with modern control technologies or through good plant design.

Geothermal energy harnesses naturally occurring geothermal formations, using the steam to produce electricity and returning spent brine to the geothermal resource. Emissions associated with geothermal sources can include hydrogen sulfide, arsenic, mercury, radon 22, and ammonia. The cooling towers at geothermal power plants can emit particulate matter. All of these emissions can be minimized with modern control technologies or through good plant design.

Hydroelectric power uses the potential energy of water to turn turbines that generate electricity. Small hydropower projects that capture the energy of water (100 kilowatts to 30 MW) without requiring a new or increased appropriation or diversion of water are considered a renewable resource under current California law. These types of projects would take advantage of constructed waterways, such as aqueducts, canals, pipelines and ditches. These types of projects do not have associated air emissions.

If natural gas-powered power plants were substituted entirely with zero-emission renewable sources through the RPS, air emissions would be reduced by 3.6 TPD NOx and 2.1 TOD PM2.5 for an increase in renewable sources from 2006 levels to 20 percent, and by 6.2 TPD NOx and 3.6 TPD PM2.5 for an increase in renewable sources from 20 to 33 percent.

The addition of significant new renewable resources may also alter the needed transmission infrastructure as renewable facilities are constructed to maximize resource capture at sites with optimal wind, solar, and geothermal resources. ARB has not evaluated the air quality impacts of changes or additions to transmission infrastructure, but notes that there is an ongoing process to examine this issue for several western states and provinces – the Renewable Energy Transmission Initiative (RETI). RETI is also prioritizing the addition of specific renewable projects to optimize the efficiency and minimize the environmental impact of new transmission infrastructure. There are no long-term air emissions associated with transmission lines, but there are short-term co-pollutant emissions associated with construction that can be minimized through best practices and project design.

Summary of Co-Pollutant Emissions

Table H-4 presents the estimated co-pollutant benefits from the recommended measures in the Electricity and Natural Gas Sector.

Table H-4: Estimated Statewide Co-Pollutant Emission Changes from Electricity and Natural Gas Sector Measures in Scoping Plan
(tons per day in 2020)

Measure	NOx	PM 2.5	ROG	CO	SOx
(E-1) Energy Efficiency (Electricity)	-7.0	-4.0	-1.0	-14.2	-0.6
(CR-1) Energy Efficiency (Natural Gas)	-10.4	-0.8	-0.6	-4.9	-0.1
(CR-2) Solar Hot Water	-0.3	-0.03	-0.02	-0.2	0
(E-4) Million Solar Roofs	-1.0	-0.6	-0.1	-2.0	-0.1
(E-2) Increase Combined Heat and Power (change from boiler to CHP) [a]	-2.0	+0.6	-0.7	-12.7	+0.1
(E-2) Increase Combined Heat and Power (avoided grid electricity) [a]	-6.4	-4.3	-0.9	-13.2	-0.6
(E-3) Renewables Portfolio Standard	-9.8	-5.6	-1.4	-19.9	-0.8
Electricity and Natural Gas Sector Total [b]	**-36.8**	**-14.3**	**-4.6**	**-67**	**-2.1**

[a]Combined Heat and Power emission changes were not included in the public health analysis, due to uncertainty in where they would occur.
[b]Numbers may not add up as presented due to rounding.

4. WATER

Regulatory Background

The operation and maintenance of water facilities and related infrastructure do not generally have significant direct air emissions. Significant emissions are indirect and the result of the electricity and natural gas use related to water. Construction activities would have temporary impacts on air resources, and are regulated by local AQMDs and APCDs, while construction equipment is regulated by ARB.

(W-1) Water Use Efficiency 1.4 MMTCO$_2$E

This measure identifies the potential for statewide water use efficiency improvement through implementation of individual i.e. per capita voluntary water conservation goals. Increasing statewide, total water demand can be met through individual end use efficiency improvements (appliances and fixtures that use less water than existing appliances and fixtures) and through individual water conservation (changes to behavior and practices). Water demand is expected to grow under the BAU scenario, but it is not clear precisely what the net change in water demand will be in 2020. Measure E-1 estimates energy efficiencies including benefits of water use efficiency. Best management practices and high efficiency appliances and fixtures such as water heaters, washing machines, faucets, shower heads, toilets, and irrigation systems reduce individual water demand. Significant air emissions associated with water use are indirect and result from the embedded energy required to move, treat, use, and dispose of or reuse that water.

This measure generates 1.76 (1.8) million acre-feet (MAF) of urban water supply to meet approximately two-thirds of the expected 2020 BAU growth in demand. Currently, the municipal and industrial use of water accounts for about 20% (8.8 MAF) of the State's total 44 MAF annual demand and is expected to increase by about 30% from 2005 through 2020. Agricultural water use accounts for the other 80% or about 35 MAF. While the water and associated emission reductions generated by this measure are assumed under baseline/BAU (BAU) i.e. they are not additional, were it not for this measure the states energy use would

increase by an estimated 5,150 GWh (approximately 16 percent of E-1). Translating this energy use into avoided use of CCNGTs yields a reduction of 1.16 TPD NOx, 0.29 TPD PM2.5, 0.12 TPD ROG, and 0.05 TPD SOx.

(W-2) Water Recycling 0.3 MMTCO$_2$E

This measure proposes to increase water supply reliability to meet increasing demand by increasing water recycling in locations where the energy associated with recycling is less than the energy associated with transporting and treating water. While the water and associated emission reductions generated by this measure are also assumed under BAU i.e. not additional, avoiding the need to import new water supplies by recycling water nevertheless avoids the increased emissions that would otherwise be the case. Recycled water is used primarily for landscaping and industrial processes. Again, the only air emissions are those from the energy use associated with the water. The avoided emissions from using 0.5 MAF of recycled water per year instead of importing new supply is estimated as 1,250 GWh (approximately 4 percent of E-1). Translating this savings into avoided use of CCNGTs yields a reduction of 0.28 TPD NOx, 0.07 TPD PM2.5, 0.03 TPD ROG, and 0.01 TPD SOx.

(W-3) Water System Energy Efficiency 2.0 MMTCO$_2$E

This measure proposes to reduce the amount of energy used to transport, treat and deliver water. Reductions in air emissions are directly relative to reductions in energy use. A target of 20% efficiency improvement yields 4,400 GWh electricity savings (approximately 14 percent of E-1). Translating this savings into avoided use of CCNGTs yields a reduction of 0.99 TPD NOx, 0.24 TPD PM2.5, 0.10 TPD ROG, and 0.04 TPD SOx. Measure E-1 includes these energy savings and associated criteria pollutant reductions.

(W-4) Reuse Urban Runoff 0.2 MMTCO$_2$E

This measure proposes to increase local surface and groundwater supplies by adopting stormwater management strategies, such as Low Impact Development (LID). LID increases infiltration in urban areas increasing regional stormwater capture and storage. Constructing neighborhood facilities to capture and reuse dry weather flows also increases local supply. These water supplies (270,000 - 333,000 acre-feet) can be used to avoid the need for new imported water supplies with higher energy-intensity. While the water and associated emission reductions generated by this measure are also assumed under BAU i.e. not additional, avoiding the need to import new water supplies by reusing runoff avoids increased emissions that would otherwise be the case. The amount of energy savings obtained through this measure relative to new imported supply is estimated as 632 - 781 GWh (1 - 2 percent of E-1). Translating this savings into avoided use of CCNGTs yields a reduction of 0.14 – 0.18 TPD NOx, 0.02 TPD PM2.5, and 0.01 TPD ROG.

There are air quality impacts associated with the construction of these types of structures - primarily from fugitive dust and diesel particulates from operation of construction equipment. These impacts could be significant but would be temporary and would also most likely employ best management practices to minimize dust. ARB's implementation of the Diesel Risk Reduction Plan includes reducing diesel particulates from construction equipment operation by 2020.

(W-5) Increase Renewable Energy Production 0.9 MMTCO$_2$E

This measure proposes to develop renewable energy projects on lands associated with California's state and local water infrastructure. The air emissions associated with these types of projects are evaluated in measure E-3. The amount of renewable energy obtained through this measure is estimated as 2,100 GWh (approximately 4 percent of E-3). Translating this savings into avoided use of CCNGTs yields a reduction of 0.46 TPD NOx, 0.11 TPD PM2.5, 0.05 TPD ROG and 0.02 TPD SOx. Measure E-3 includes these energy savings and associated GHG emission reductions and criteria pollutant reductions

(W-6) Public Goods Charge for Water TBD MMTCO$_2$E

This measure proposes to impose a monetary charge on water use and to use resulting funds to reduce the GHG emissions from water-related energy use, as described in measures W-1 through W-5. Measures W-1 through W-5 are evaluated separately.

Summary of Co-Pollutant Emissions

Table 4 presents the co-pollutant benefit estimations for the proposed Water Sector regulations. These benefits are assumed under BAU or accounted for in the Electricity and Natural Gas sector.

Summary of Co-Pollutant Emissions

Table H-5 presents the estimated co-pollutant benefits from the recommended measures in the Water Sector. Many of these benefits are assumed to occur under the BAU scenario or they are accounted for in the Electricity and Natural Gas sector estimates.

Table H-5: Estimated Statewide Co-Pollutant Emission Changes from Water Sector Measures in Scoping Plan
(tons per day 2020)

Measures[a]	NOx	PM 2.5	ROG	CO	SOx
(W-1) Water Use Efficiency	-1.1	-0.7	-0.2	-2.3	-0.10
(W-2) Water Recycling	-0.3	-0.2	-0.04	-0.6	-0.02
(W-3) Water System Energy Efficiency	-1.0	-0.6	-0.1	-2.0	-0.08
(W-4) Reuse Urban Runoff	-0.1	-0.1	-0.02	-0.2	-0.01
(W-5) Increase Renewable Energy Production	-0.4	-0.3	-0.1	-0.9	-0.04
(W-6) Public Goods Charge for Water	--	--	--	--	--
Water Sector Total [b]	**-3.0**	**-1.7**	**-0.4**	**-6.0**	**-0.3**

[a] Greenhouse gas reductions from the Water sector are not currently counted toward the 2020 goal. ARB anticipates that a portion of these reductions will be additional to identified reductions in the Electricity sector and is working with the appropriate agencies to refine the electricity/water emissions inventory.

[b] Numbers may not add up as presented due to rounding.

5. INDUSTRY

Regulatory Background

The air emissions of all stationary sources in California are regulated. Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Applicable air quality regulations are described in the last section of this Appendix.

(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources TBD $MMTCO_2E$

This recommended measure would require large stationary sources of GHG emissions to conduct an audit to determine whether cost-effective GHG reductions that also provide needed co-pollutant emission reductions are available. Based on the results of these audits, ARB will consider rule revisions or permit conditions to ensure the best combination of pollution reduction. This recommended measure is designed to balance GHG and co-pollutant reductions. The co-pollutant benefits of this measure will depend on the results of the audits so are unknown at this time. The GHG measures for industrial sources (described below) provide some indication of the possible control measure, and some indication of the potential magnitude of co-pollutant reductions from large industrial sources.

(I-2) Oil and Gas Extraction GHG Emission Reduction 0.2 $MMTCO_2E$

This measure would address fugitive methane emissions from the oil and gas extraction process, including both on and off-shore sources. Approximately 5 percent of the oil and gas extraction-related GHG emissions come from fugitive sources. Net criteria pollutant emission reductions are estimated to be 0.3 TPD VOC.

(I-3) GHG Leak Reduction from Oil and Gas Transmission 0.9 $MMTCO_2E$

This measure would address fugitive emissions from the transmission and distribution of natural gas throughout California. This transmission involves approximately 12,000 miles of pipeline. Transmission-related emissions come primarily from fugitive sources and consist primarily of methane. Net criteria pollutant emissions reductions from controlling fugitive sources are estimated to be 1.3 TPD VOC.

(I-4) Refinery Flare Recovery Process Improvements 0.33 $MMTCO_2E$

This measure would require oil refineries to increase the gas-recovery capacity of their flare systems to capture these gases before combustion in the flares and reroute them into various refinery processes. Staff is also evaluating tying into the flare system remote pressure-relief devices that currently discharge to the atmosphere. Finally, this measure assumes best management practices regarding planned shutdowns and flare activity. Staff estimates that flare emissions would be halved by this measure.

Using natural gas as a surrogate for flared gases, this measure could reduce NOx by 0.8 TPD and PM2.5 by 0.02 TPD. ARB is establishing a technical working group to explore the potential GHG and other air emission reductions that can be achieved through improving process efficiencies.

(I-5) Removal of Methane Exemption from Existing Refinery Regulations

0.01 $MMTCO_2E$

This measure would remove the existing fugitive methane exemption from regulations applicable to equipment and sources within refineries. Storage tanks, wastewater treatment facilities, and process losses (leaks) are all sources of fugitive methane emissions. Practices employed to implement this measure, including improved inspection and repair, could also reduce VOC emissions.

Summary of Co-Pollutant Emissions

Table H-6 presents the estimated co-pollutant benefits from the recommended measures in the Industry Sector. Changes in co-pollutant emissions could not be estimated for all measures due to the specificity of the measures or lack of underlying data. Emission reductions that could not be estimated are not included in the table.

Table H-6: Estimated Statewide Co-Pollutant Emission Changes from Industry Sector Measures in the Scoping Plan
(tons per day in 2020)

Measure	NOx	PM2.5	CO	SOx	VOC
(I-2) Oil and Gas Extraction GHG Emission Reduction	0	0	0	0	-0.3
(I-3) GHG Leak Reduction from Oil and Gas Transmission [a]	0		0		-1.3
(I-4) Refinery Flare Recovery Process Improvements	-0.8	-0.02			
Quantified Industry Sector Total	**-0.8**	**-0.02**	**0**	**0**	**-1.6**

[a] Changes in co-pollutant emissions could not be estimated for all measures due to the specificity of the measures or lack of underlying data. Emission reductions that could not be estimated are not included in the table.

6. RECYCLING AND WASTE MANAGEMENT

Regulatory Background

Air emissions from the construction and operation of Municipal Solid Waste (MSW) landfills and combustors, material recovery facilities (MRFs) and composting facilities are regulated to support maintenance and attainment of **National Ambient Air Quality Standards (NAAQS).** The last section of this Appendix more fully describes these regulations. The State, through the CIWMB, ARB, and State Water Resources Control Board (SWRCB), has been working to reduce the environmental impacts of solid waste management for many decades. Local governments have the primary responsibility for managing solid waste. The **CIWMB** requires the development of regional **Integrated Waste Management Plans (IWMPs)** by local agencies.

IWMPs and some projects identified within IWMPs will have to comply with the **California Environmental Quality Act (CEQA)**. CEQA requires proposed plans and facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.

Much of the environmental protections around solid waste management are implemented at a local government level. State waste management programs are primarily carried out through **local solid waste enforcement agencies (LEAs)**. LEAs have the primary responsibility for ensuring the correct operation and closure of solid waste facilities in the state. They also have responsibilities for guaranteeing the proper storage and transportation of solid wastes.

(RW-1) Landfill Methane Control Measure 1.0 MMTCO$_2$E
(RW-2) Additional Reductions in Landfill Methane: Increase the Efficiency of Landfill Methane Capture TBD MMTCO$_2$E

Landfills are managed to protect human health and the environment. Although landfills are regulated to minimize decomposition of wastes in landfills, some anaerobic decomposition of organic wastes creates byproducts of gaseous methane and carbon dioxide, plus trace gas constituents. Methane and carbon dioxide are both GHGs, with methane being 21-22 times more potent than carbon dioxide. Large landfills typically have gas collection and control systems to collect and destroy (by flaring or using an energy recovery device) the methane emissions and TACs and are required to meet fugitive surface emission standards. Some smaller landfills do not currently collect or control methane emissions; however, if the landfill is properly capped, the amount of unintended emissions could be significantly reduced. Measure RW- 1 will require the installation of gas collection and control systems at smaller and other uncontrolled landfills that are currently not required to install emission controls. The measures also establish statewide standards for the gas collection and control system, including methane destruction efficiency requirements and landfill methane surface emission standards, for all landfills where systems are required. The collection and control of landfill gas may increase the amount of flared gases, and subsequently might also increase NOx and CO emissions but may decrease TACs like benzene or vinyl chloride. Measure RW-2 proposes to develop best management practices and standards to minimize fugitive methane emissions.

(RW-3) High Recycling/Zero Waste 9 MMTCO$_2$E

Commercial Recycling recommends developing voluntary commercial recycling goals. Commercial facilities generate over half of the State's solid waste, and much of it is recyclable. Commercial recycling of materials potentially avoids or reduces emissions associated with full production cycles and landfills. Full production cycles may occur outside of the state.

Increasing Production and Markets for Compost could double the amount of organic material diverted from landfills by creating compost instead. The use of compost can reduce water demands of vegetation, reduce the amount of chemical pesticides used for weed control, and reduce chemical fertilizer applications. VOCs and NOx can be byproducts of the compost manufacturing process and are a function of the compost feedstock, the amount of mechanical mixing, and the emission controls on mechanical equipment. Diesel related emissions may also be associated with the equipment used at compost facility operations; however, the same amount of diesel related emissions may also occur in the processing and application of chemical fertilizers. A comparison of emissions will need to occur in order to more fully assess benefits or impacts. VOCs are precursors to ozone generation: both ozone precursors and diesel emissions are currently regulated by ARB and local air districts. ARB and local air districts seek to reduce emissions in order to achieve the goals of the 2007 SIP to meet the national ozone and PM2.5 standards. This measure would also reduce landfill gas (by diverting materials from landfills) and potentially reduce chemical fertilizer emissions, but could potentially generate VOCs. ARB

and CIWMB have established a working group to guide research into VOC and GHG production during composting.[67]

The **anaerobic digestion** of human, animal, or wet organic wastes produces a gas of 50 to 80 percent methane. This "biogas" can be combusted to produce electricity. Combustion of digester gases must also be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as anaerobic digestion generates 22 times the amount of NOx and 9 times the amount of PM as natural gas-powered power plants (per MWh). All of these emissions can be minimized with modern control technologies or through good plant design.

Extended Producer Responsibility proposes to incorporate the costs of treatment and disposal into the total cost of a product. This should result in environmentally preferable products, as manufacturers seek to reduce overall product costs by minimizing treatment and disposal costs. **Environmentally Preferable Purchasing** would encourage the purchase of environmentally preferable products, products which use less energy, water, virgin materials and hazardous chemicals to produce. These measures intent is to reduce environmental impacts of product manufacturing. Because of the broad spectrum of products, and the geographical extent of extraction and manufacturing, it is not possible to specifically describe potential benefits to air quality in California, although some of these benefits would be the reduced demand for landfilling.

7. FORESTS

Regulatory Background

The 33 million acres of California's forests, forest type, species composition, ownership and management are very diverse. Approximately 45 percent of these acres are privately owned with about 52 percent under federal ownership, and 3 percent is owned by the State or local governments. Management of forests is strongly influenced by land ownership goals. With respect to air emissions: forests remove carbon as they grow; but emissions of criteria pollutants from fires can negatively affect air quality. Several sources of air emissions associated with forest activities are already regulated by the State:

> **Off-road equipment** used for operation and maintenance activities in forests is regulated by ARB to reduce criteria pollutant emissions. Timber harvesting and forest management activities that could have temporary impacts on air resources are regulated by local AQMDs and APCDs.
>
> The **California Board of Forestry and Fire Protection** (BoF) is authorized to provide direction for fuels management to reduce the risk of wildfires. Wildfires are a natural and necessary element of the forest lifecycle, but fires, especially catastrophic ones can have significant air quality impacts.

(F-1) Sustainable Forest Target 5 MMTCO$_2$E

BoF has very broad authority, including a role as a forest practice regulation entity, a role in setting the policy and the structure for fire protection in California, and also the responsibility to represent the State in federal forestry issues. This measure recommends establishing and

[67] http://www.arb.ca.gov/cc/compost/compost.htm

implementing a target to sustain current levels of net carbon sequestration in the Forest sector with actions such as reforesting areas lost to wildfires and improving forest management to reduce the risk of catastrophic wildfires in the state. One of the main co-benefits of this measure is reduced emissions of criteria pollutants from large fires which can significantly impair air quality. Emissions from additional operation and maintenance activities to reduce the risk of catastrophic fires and to increase afforestation and reforestation will be minimized by existing off-road equipment regulations. Air emissions were not quantified because the measure is still under development. The benefits and impacts of this measure will be further evaluated as specific details are developed.

8. HIGH GWP

Regulatory Background

Chemicals, refrigerants and consumer products are regulated at both federal and state levels. At the federal level:

> Toxicity levels, exposure rates, release data and disposal information for a wide range of **chemicals** are gathered and disseminated by U.S. EPA. U.S. EPA works with industry to implement chemical uses that will diminish the damage caused to the environment and human life and to establish protocols for spills and other accidents.[68]
>
> At a federal level, **refrigerants** identified as ozone depleting substances are regulated by U.S. EPA as a result of the 1990 Clean Air Act Amendments. U.S. EPA regulates the sale, servicing and recovery operations involving ozone depleting substances used as refrigerants. Mobile sources are regulated in coordination with the National Institute for Automotive Service Excellence and the Mobile Air Conditioning Society. The Society of Automotive Engineers industry sets standards for technical specifications related to motor vehicle air conditioning system (MVAC) servicing issues. U.S. EPA also sets appliance standards.
>
> **Workplace safety protection** from exposure to refrigerants and chemicals is regulated by the Occupational Safety and Health Administration with safety limits established by the National Institute of Occupational Safety and Health.

At the state level:

> ARB regulates **mobile sources**, including refrigerant systems and servicing. Local air districts regulate **stationary sources.** ARB also has authority to adopt regulatory requirements for chemically formulated **consumer products**. The focus of ARB's consumer product regulations is the reduction of VOCs and ozone depleting substances.
>
> The Office of Environmental Health and Hazard Assessment evaluates the risks posed by hazardous substances (**chemicals**) and sets appropriate standards to protect human health and the environment.

[68] http://www.epa.gov/ebtpages/pollchemicals.html

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing 0.26 $MMTCO_2E$

The primary purpose of this Discrete Early Action is to reduce the emissions of the high global warming potential (GWP) gas HFC-134a, a potent GHG with a GWP of 1,300, from activities associated with do-it-yourself (DIY) charging. HFC-134a is not regulated as an ozone precursor, a contributor to particulate matter, or as a toxic air contaminant. Leakage of HFC-134a from motor vehicle refrigerant systems is not associated with criteria pollutants or TACs; therefore, this measure is not anticipated to affect air resources.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications 0.3 $MMTCO_2E$

This Discrete Early Action measure will consider a potential ban on the use of sulfur hexafluoride (SF_6) where technologically feasible and cost-effective alternatives are available, as well as a performance standard for other uses. The main uses of SF_6 in California that are not directly related to utilities or semiconductor manufacturing include: magnesium casting, tracer gas use (including fume hood testing), and medical uses (ultrasounds, eye surgery). Alternative gases are being pursued for magnesium die-casting and tracer gas uses. Medical use emissions appear to be very low, and are proposed to be exempt from SF_6 bans due to low emissions, high costs, and lower effectiveness of alternatives. Neither SF_6 nor its replacement gases are criteria pollutants or TACs; therefore, this measure is not expected to affect air resources.

(H-3) High GWP Reduction in Semiconductor Manufacturing 0.15 $MMTCO_2E$

This measure recommends requiring manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce high GWP emissions from semiconductor manufacturing. This measure considers an existing U.S. EPA voluntary program. There are currently no known replacements for the high GWP gases used in this industry, so efforts have focused on using additional abatement equipment and developing processes to reduce their use of high GWP gases. Individual fabricators would determine the optimal methods of compliance. There are no anticipated effects on criteria pollutants or TACs.

(H-4) Limit High GWP Use in Consumer Products 0.25 $MMTCO_2E$

At its June 2008 Board Hearing, ARB approved amendments to the Consumer Products Regulation that will attain approximately a 0.23 $MMTCO_2E$ per year reduction from Pressurized Gas Dusters (2020 reductions). In the 2009-2010 timeframe, staff will evaluate other GHG reduction opportunities from Consumer Products and may propose more regulations to attain additional reductions. Consumer Products are also regulated to reduce VOC and TAC emissions. Additional regulations would include analysis to limit the replacement of high GWPs with lower GWPs that could contribute to the formation of ground level ozone.

(H-5) High GWP Reductions from Mobile Sources 3.3 $MMTCO_2E$

The **Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems** measure recommends requiring low GWP refrigerants with overall improved lifecycle climate performance for new MVAC systems, with initial emphasis on systems used for heavy-duty and off-road vehicle application, followed by requirement for light-duty vehicles. The employment of low GWP refrigerants is not expected to affect air emissions.

The **Air Conditioner Refrigerant Leak Test during Vehicle Smog Check** measure recommends reducing the number of in-use MVACs that leak excessively by identifying them through the existing Smog Check program and requiring their subsequent repair. This measure

would prevent the ongoing "leak-recharge-leak" cycle associated with the use of small cans of refrigerant by do-it-yourselfers to systems that need repair but are not fixed. Leakage of HFC-134a from motor vehicle refrigerant systems is not associated with any regulated air contaminants; therefore, this measure is not anticipated to affect air resources.

The **Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers** measure recommends recovering refrigerant remaining in the decommissioned containers' cooling systems, reducing leakage from these containers, and ensuring proper disposal as they approach their end-of-life. Leakage of these types of refrigerants is not associated with any regulated air contaminants; therefore, this measure is not anticipated to affect air resources.

The **Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems** measure recommends improving compliance with existing regulations prohibiting the venting of certain types of refrigerant, including HFCs, to the atmosphere when MVAC equipment is serviced or dismantled.[69] Venting is avoided by recovering refrigerants with specialized equipment before dismantling or servicing. The recovered refrigerant can be re-used or transferred to re-processors approved by U.S. EPA for proper disposal. Leakage of HFC-134a from motor vehicle refrigerant systems is not associated with any criteria pollutants or TACs; therefore, this measure is not anticipated to affect air resources.

(H-6) High GWP Reductions from Stationary Sources 10.9 MMTCO$_2$E

Two measures are proposed in the **High GWP Stationary Equipment Refrigerant Management Program.** The **Refrigerant Tracking/Reporting/Repair/Deposit Program** measure recommends requiring commercial and public facilities with large stationary air conditioning and refrigeration equipment to minimize emissions of high GWP refrigerants through reporting, leak repair, improved servicing, and end-of-life control. The **Specifications for Commercial and Industrial Refrigeration Systems** measure proposes new specifications for commercial and industrial refrigeration systems to both reduce emissions of high GWP refrigerant and to increase energy efficiency of the units. There are no criteria pollutants or TACs associated with commercial and industrial refrigeration systems; therefore, this measure is not anticipated to affect air resources.

Insulation foam that is diverted to landfills emits high GWP gases into the atmosphere.[70] The **Foam Recovery and Destruction Program** measure recommends minimizing these emissions to as close to zero as possible by diverting waste foam away from landfills and destroying the foam at high temperatures, or by capturing the high-GWP GHGs within the foam and destroying the foam gas. There is a potential for criteria pollutants and toxic emissions if the recovered foams are combusted at high efficiency treatment facilities. This would be further evaluated during regulation development.

[69] Existing federal regulation (40 CFR 82.154) bans the release to the atmosphere of high GWP refrigerants at the end-of-life or during equipment servicing.
[70] USEPA, U.S. High GWP Emissions 1990-2010: Inventories, Projections and Opportunities for Reductions, EPA 000-F-97-000, June 2001.

Gas-insulated circuit breakers and gas-insulated substations are sources of fugitive SF_6 emissions in California electricity systems, and older equipment generally produces more fugitive emissions than newer equipment. Particle accelerators emit SF_6 from equipment similar to that found in electricity systems and use SF_6 as a quenching medium. The **SF_6 Leak Reduction and Recycling in Electrical Applications** measure recommends reducing emissions of SF_6 within the electric utility sector and at particle accelerators by requiring the use of best achievable control technology for the detection and repair of leaks, and the recycling of SF_6. Additionally, particle accelerator industry representatives are considering the use of possible substitute mediums. Neither SF_6 nor its replacement gases are criteria pollutants or TACs; therefore, this measure is not expected to affect air resources.

The **Alternative Suppressants in Fire Protection Systems** measure recommends evaluating the use of alternative suppressants in total flooding (fixed) and streaming (portable) fire suppression systems. Neither existing nor alternative suppressants are criteria pollutants or TACs; therefore, this measure is not expected to affect air resources.

The **Residential Refrigeration Early Retirement Program** measure recommends partnering with existing voluntary programs to retire inefficient residential refrigeration appliances such as refrigerators and freezers. Appliance early retirement includes the recovery of high-GWP refrigerants and blowing agents for reclamation or destruction to avoid GHG emissions. There are no criteria pollutants or TACs associated with these refrigeration systems.

(H-7) Mitigation Fee on High GWP Gases 5 $MMTCO_2E$

This measure recommends attaching a fee to the use of high GWP gases. This measure would support the goal of reducing high-GWP gas emissions and therefore have similar effects as Measures H-1 through H-6. No reductions of criteria pollutants or TACs are expected.

9. AGRICULTURE

Regulatory Background

Anaerobic digesters are regulated as stationary sources. Applicable air quality regulations are described in the last section of this Appendix.

(A-1) Methane Capture at Large Dairies 1.0 $MMTCO_2E$

This is a voluntary measure. Methane from dairy manure can be captured through the installation and use of anaerobic digesters. The anaerobic digestion of animal wastes produces a gas of 50 to 80 percent methane. This “biogas” produced by the digester can be used as an alternative to natural gas in combustion, power production, or as a transportation fuel. Digester gas-based electricity generates 22 times the amount of NOx and 9 times the amount of PM as electrical grid natural gas power plants (per MWh). Controls can reduce the amount of NOx in exhaust gases, but the types and sizes of engines typically used in conjunction with a dairy digester may not be available, cost effective or able to meet local air district NOx requirements. Using “biogas” as a transportation fuel could replace diesel combustion in farm-related equipment and truck trips.

10. SUMMARY

From a statewide perspective, the recommended measures of the Scoping Plan will generally benefit air resources in California. The majority of this benefit will come through reduced and

avoided combustion of gasoline, diesel, and natural gas. Higher polluting fuels, like diesel, will transition to lower polluting and non-polluting fuels, while increased efficiencies and implemented transportation targets work to reduce the overall demand for these fuels at the same time that population within the state is increasing. Implementation of the Cap and Trade regulation should further reduce criteria pollutants and TACs. Table H-7 summarizes the estimated NOx and PM2.5 reductions that are used to estimate public health benefits later in this Appendix.

Table H-7: NOx and PM2.5 Statewide Reductions from Recommended Scoping Plan Measures used in Public Health Evaluation
(tons per day)

Measure	NOx	PM2.5
Light-Duty Vehicle • Pavley I and Pavley II GHG Standards • Vehicle Efficiency Measures	1.6	1.4
Goods Movement Efficiency Measures	16.9	0.6
Medium and Heavy-Duty Vehicle GHG Emission Reduction • Aerodynamic Efficiency • Hybridization	5.6	0.2
Regional Transportation-Related GHG Targets	8.7	1.4
Energy Efficiency (Electricity)	7.0	4.0
Energy Efficiency (Natural Gas)	10.4	0.8
Solar Water Heating	0.3	0.03
Million Solar Roofs	1.0	0.6
Renewables Portfolio Standard	9.8	5.6
Total	**61**	**15**

There is a potential for these improvements to occur unevenly throughout the state, although it will be difficult to assess how much of this is due specifically to AB 32 implementation. There are also some potential pathways under consideration (such as biomass to energy or ethanol production) which may have higher associated criteria pollutants or TACs than other potential pathways. The geographical diversity of actual criteria pollutant and TAC reductions will depend on further regulation development and implementation pathways. The ARB regulatory process, as well as AQMD and APCD regulations, existing environmental regulations, and regional air quality plans would partially prevent and publicly disclose potentials for local increases in criteria pollutants and TACs.

B. LAND RESOURCES

California is the third largest state in the United States, encompassing almost 100 million acres of land and 5 million acres of water areas. The federal government holds approximately 23 million acres and manages them as federal parks, forests, and conservation areas. The federal government also holds and manages mineral and resource rights on an additional 45 million acres. The State holds 1.5 million acres of land as parks, forests, and conservation areas. Approximately 27 million acres are in agricultural production (27 percent of total state acreage) and 3.9 million acres are urbanized. There are 56 cities with populations over 100,000, including four of the country's 25 largest cities: Los Angeles, San Diego, San Jose, and San Francisco.

Regulatory Background

Open spaces and agricultural resources are special categories of land resources where there are concerns about impacts and conversions. Land resources in California are currently protected through:

The **California Land Conservation Act of 1965**, known as the Williamson Act, enables local governments to enter into contracts with private landowners to restrict properties to agricultural and open space activities.

CEQA requires proponents of proposed projects to describe the potential for environmental impacts, including impacts to Williamson Act contracts and to established land uses, through a public process. CEQA also requires General Plans to describe the potential for environmental impacts through a public process.

Local Agency Formation Commissions in each county adopt spheres of influence for each city within the county, and make determinations on changes to those boundaries. Their decisions can influence air quality in the way in which they allow additional development to occur.

Evaluation Context

ARB examined the potential effects of the recommended measures in the Scoping Plan on land resources in California. Potential impacts that extend outside of the state are identified, but the potential effects on land resources out of state were not evaluated.

Evaluation Process

Where possible, existing studies, environmental documentation, and regulatory documentation for measures were reviewed for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was available, ARB consulted experts at state agencies, including at ARB and Climate Action Team agencies. More detailed information about the recommended regulations and the measures under evaluation is provided in Appendix C of the Scoping Plan, as well as in the previous section evaluating air resources.

1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE

Land use considerations are determined by local governments and no land use or planning requirements would be mandated or altered by this recommended measure. Instead, the recommended measure would require capped entities that have already received permits to operate consistent with existing land easements and ordinances to comply with AB 32 requirements and the cap and trade regulation. Offset projects would have to comply with existing land use regulations as well as AB 32 requirements.

2. TRANSPORTATION

(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards 31.7 $MMTCO_2E$
Feebates - In-lieu of Pavley Regulations 31.7 $MMTCO_2E$
(T-4) Vehicle Efficiency Measures 4.5 $MMTCO_2E$

There are no anticipated changes to land use as a result of these measures, as they are not projected to affect the total number of vehicles in the state.

(T-2) Low Carbon Fuel Standard 15 $MMTCO_2E$

Although the Low Carbon Fuel Standard is still in the regulatory development process, there are likely to be a variety of ways in which the final regulatory requirements can be met. There are potential land resource issues associated with the biofuels pathways, particularly those related to the potential for biofuel crops to replace food crops. The impacts associated with renewable energy to generate hydrogen or electricity for vehicles is evaluated in the electricity and natural gas section.

Biofuel Raw Materials – Waste Materials: The conversion of waste materials to fuels would reduce the need for landfill space in the state.

Biodiesel – Soy: The majority of soybeans needed to fill the anticipated 2020 demand for soy-based biodiesel is projected to be produced out-of-state. Midwestern states and Texas are currently the largest growers of soybeans, and out-of-state biodiesel plants using soybeans tend to be located close to production fields. California could meet future biodiesel demands either through importing soybeans and other raw materials or through importing finished biodiesel. Potential land resource issues related to the use of soybeans to produce fuel include the conversion of undeveloped/natural habitats to agriculture and the conversion of food-based agriculture lands to fuel-based agriculture lands. These issues will be further evaluated as part of the LCFS regulatory development process.

Biodiesel Production Facilities: Biodiesel production facilities are usually sited based on access to feedstock and the market for the finished product. Production facilities processing out-of-state feedstocks need to be accessible to truck and rail routes. Facilities processing recycled waste tend to be located closer to the sources of that waste – restaurants and industrial facilities. Facilities sited in industrial-zoned areas will already be compatible with existing land use designations since biodiesel production falls into the industrial category. Potential land use impacts could occur if non-compatible areas are rezoned to accommodate the siting of new production facilities. Preliminary analysis for the LCFS estimates a projected maximum demand for biodiesel in California by 2020 that could require the equivalent of almost 30 new 25 million gallon-capacity biodiesel production facilities.

Ethanol – Corn: Food-to-fuel crop conversion acreage estimates are currently under development as part of the LCFS regulatory process. Potential land resource issues related to the use of corn to produce fuel include the conversion of undeveloped/natural habitats to agriculture and the conversion of food-based agriculture lands to fuel-based agriculture lands. These issues will be further evaluated in the LCFS regulatory development.

Ethanol – Cellulosic: Less is known about the potential land use issues with cellulosic agriculture, which may be heartier than food crops and thus can be cultivated in locations where food cannot be economically cultivated. Most cellulosic feedstocks will consist of woody waste materials (corn stover and other crop residues, waste wood chips, and municipal solid waste) which would derive from existing land uses. The only potential land resource issues related to the use of cellulosic materials to produce fuel would occur where (and if) undeveloped/natural habitats or food-based agriculture lands are converted to fuel-based agriculture lands. These issues will be further evaluated in the LCFS regulatory development.

Ethanol Production Facilities: Ethanol production facilities typically need access to sources of feedstock, users of their waste products, and to the market for this finished product. Facilities sited in industrial-zoned areas generally will not cause as many land use concerns as siting in undeveloped areas. Potential land use impacts could occur if non-compatible areas are rezoned to accommodate siting of new ethanol production facilities. The preliminary analysis for the LCFS proposal estimates a maximum projected need for ethanol in California by 2020 that could require the equivalent of over 50 new 50 million gallon-capacity plants.

Hydrogen: Land use issues related to renewably-produced hydrogen resources are discussed in the Electricity and Natural Gas Section. Hydrogen production stations are typically constructed in developed, populated areas and within zoning that allows for a production station. Stations that use natural gas or on-site solar power as the energy source for production would probably not raise land resource issues if located in developed areas.

(T-5) Ship Electrification at Ports 0.2 $MMTCO_2E$

(T-6) Goods Movement Efficiency Measures 3.5 $MMTCO_2E$

Ports and highway infrastructure may continue to expand to meet the increasing demand for goods movement. No new ports or rail yards are currently anticipated and existing rail yards are not expected to expand.[71] ARB does not anticipate that implementation of the Scoping Plan will affect port infrastructure activities beyond the business as usual scenario. ARB will develop strategies for improving the efficiency of goods movement, with the goal of improving air quality. The majority of the measures expected to be included in these strategies will essentially recommend physical or operational and maintenance changes to vehicles and equipment, but not change the future numbers of vehicles and equipment. In general, these measures are not expected to effect changes in land uses. Some measures recommend replacing diesel engines with grid electricity, which would increase the demand for electricity. If construction of new facilities or repowering of existing facilities is required to meet this increased demand, these measures could collectively impact land resources. The impacts of new facilities are described in the Electricity and Natural Gas sector evaluation.

[71] Goods Movement Action Plan.

(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency 0.9 MMTCO$_2$E

(T-8) Medium and Heavy-Duty Vehicle Hybridization 0.5 MMTCO$_2$E

There are no anticipated changes to land use as a result of this measure, as this measure would not affect the total number of vehicles in the state.

(T-3) Regional Transportation-Related Greenhouse Gas Targets 5 MMTCO$_2$E

Under this measure ARB would work with MPOs to establish passenger vehicle greenhouse gas emission reduction targets (regional targets) for 2020 and 2035. The specific land resource impacts of particular land use and transportation strategies applied to implement this measure would be evaluated under existing applicable regulatory structures as they are triggered, including CEQA. Generally, this measure encourages more compact development patterns that have the potential to reduce future impacts on current natural resource and agricultural lands.

(T-9) High Speed Rail 1 MMTCO$_2$E

The Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its land use analysis. The programmatic EIR/EIS examined the impacts of the HSR on land resources, land planning, agricultural lands, and environmental justice. The analysis finds the recommended HSR would be compatible with local and regional plans that support rail systems and transit-oriented development, as well as improved inter-modal connectivity with existing local and commuter transit systems. As new transportation corridors would be developed with the HSR, there is the potential for localized land use impacts and property right impacts. The programmatic EIR/EIS identifies additional land use incompatibilities and significant impacts on agricultural lands at regional levels. Mitigation strategies and design practices are proposed to compensate these impacts. For example, the California High Speed Rail Authority has established policies regarding the use of smart growth and transit oriented development strategies for station areas to help to avoid secondary growth impacts on agricultural lands.

3. ELECTRICITY AND NATURAL GAS

Regulatory Background

The air emissions of all stationary sources in California are regulated. For power plants or energy facilities, the **CEC Certification process** serves as an equivalent to the otherwise required state and local permitting requirements. The CEC has authority to certify (permit) the construction and operation of thermal electric power plants 50 megawatts or larger and all related facilities. The site certification process provides a review and analysis of all aspects of a proposed project, including public health and environmental impacts, safety, efficiency, and reliability, equivalent to the CEQA process. The process is also a public process. Smaller facilities with no potentially significant environmental impacts can apply for an exemption process, similar to a mitigated negative declaration approach under CEQA.

The CEC works with local governments to ensure a functionally equivalent permitting process. CEC prepare the necessary evaluation in a “Preliminary Staff Assessment”, working with the local government to ensure it provides the information needed for the local government to approve the project. The final site certification serves as the local permit to construct.

(E-1) Energy Efficiency (Electricity) 15.2 $MMTCO_2E$
(CR-1) Energy Efficiency (Natural Gas) 4.3 $MMTCO_2E$

There are no expected direct land use impacts from these recommended measures. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future. A conventional natural gas plants uses approximately 1 acre per 9.6 MW; solar fields (the most land intensive source of electrical power) would require 5 to 10 acres per MW. Avoiding 32,000 GWh of electrical demand could avoid development of 520 to 46,600 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat.

(CR-2) Solar Water Heating 0.1 $MMTCO_2E$

There are no expected direct land use impacts from these recommended and under evaluation measures. Avoided demand for natural gas for home and commercial water heating would slightly reduce the impacts around the world from development of natural gas and production of liquefied petroleum natural gas.

(E-4) Million Solar Roofs 2.1 $MMTCO_2E$

Avoided demand for electricity could potentially result in a reduction of the number of power plants constructed in the future. A conventional natural gas plants uses approximately 1 acre per 9.6 MW; solar fields (the most land intensive source of electrical power) would require 5 to 10 acres per MW. Avoiding 3,000 MW of electrical demand could avoid development of 312 to 30,000 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat.

(E-2) Increase Combined Heat and Power 6.7 $MMTCO_2E$

Combined heat and power systems would be installed within existing facility boundaries, typically located in already disturbed, industrial areas. Generally, these projects are not expected to impact land resources.

The increased efficiency of combined heat and power systems would lead to avoided demand for electricity, potentially resulting in a reduction of the number of power plants constructed in the future. A conventional natural gas power plant uses approximately 1 acre per 9.6 MW; a solar field (the most land intensive source of electrical power) requires 5 to 10 acres per MW. Avoiding 4,000 MW of electrical demand could avoid development of 416 to 40,000 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat. Avoided demand for natural gas could slightly reduce the impacts around the world from development of natural gas and production of liquefied petroleum natural gas.

(E-3) Renewables Portfolio Standard 21.3 $MMTCO_2E$

This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. This requirement could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons the benefits and impacts of each renewable resources are evaluated relative to natural gas, and are not individually quantified for potential air emissions. Land resource impacts are best evaluated at the project-level, as the quality of the land resource being impacted is more important than the quantity. Project-level evaluations are currently evaluated within the CEC certification process.

Wind farms are generally located on undeveloped lands, but have a relatively small land footprint. Modern wind turbines are more powerful and require fewer turbines per acre than older generation wind turbines.

Solar thermal fields use 8 acres of land per MW on average[72] and are generally proposed in undeveloped lands in unshaded areas. The mirrors and lenses at solar thermal facilities require periodic washing, so unvegetated soils are treated to reduce erosion, but they remain porous.

There are no current large-scale **solar photovoltaic** plants operating in California, although there are several proposed. Photovoltaic plants use more land per MW than solar thermal plants, and about 80 times the acreage of a combined-cycle natural gas plant per MW. The 2007 Environmental Performance Report states that current technological advances may reduce the land footprint by up to 50 percent.

There is a current example of potential land impacts from large scale collective development of wind and solar power. The Bureau of Land Management has received applications to develop 66,200 MW of renewable energy on the lands they manage in the California desert, which could encompass up to 1.16 million acres, some of which is important biological habitat and difficult to offset in high volumes.

The land resource effects of **biomass** sources depend on the fuel type.

- The use of biomass (forest or agricultural residuals) or municipal solid waste (MSW) requires a physical plant, similar in land use patterns to natural gas power plants but generally located close to the source materials (such as landfills) to reduce transportation costs. Land use impacts associated with these facilities are highly dependent on their location. Use of waste materials precludes the need to destroy or landfill them in other manners, reducing future land resource impacts. These materials do not require additional lands for production, and the collection of the waste usually complements the operational needs of forest and agricultural practices. **Municipal solid waste** may contain hazardous materials, which could result in solid and gaseous hazardous by-products. Air emissions and ash can be treated to reduce this hazard.
- The **anaerobic digestion** of human, animal, or wet organic wastes reduces the physical amount of waste and improves the quality of the waste for disposal, requiring less land for disposal.
- Combustion of **landfill gases** occur within existing landfill facility footprints and therefore have no additional effects on land resources.

Geothermal-fueled power plants use less land than fossil-fuel power plants, but have to be located near their source, which can be undeveloped land or native habitat.

Small hydropower projects take advantage of existing disturbed environments (man made channels, aqueducts, pipelines, etc.) and therefore have a minimal impact on land resources.

[72] 2007 Environmental Performance Report. California Energy Commission. 2007.

New transmission infrastructure may be required to fully develop renewable sources. New transmissions lines may require more land resources than for natural gas power plants of similar capacity. We do not anticipate significant land resource impacts at a statewide level, since the maximum amount of difference would be around 488,850 acres.

4. WATER

Regulatory Background

Water infrastructure includes reservoirs, dams, canals, aqueducts, pipelines, pumping stations, and water treatment plants. Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Regarding land resources, new water infrastructure must comply with:

The California Environmental Quality Act requires proposed industrial facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. Water infrastructure is typically constructed by a local, regional, or state government agency and work with other local, regional, or state government agencies to determine who will serves as the lead or responsible agency for a CEQA document. Local, Regional, and State government agencies also both establish guidance for CEQA analyses and review documents for consistency with established plans and regulations. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.

Land Use/Zoning Laws determine where industrial sources can be constructed and operated. New stationary sources have to obtain a local permit determining compliance with the **General Plan** and authorizing construction. If the proposed location is not within an approved land use area, the facility will have to undergo a public process to obtain a zone change, variance, or conditional use permit, dependent on the compatibility of the facility with the location. Land use permits require environmental review. There are also local building codes in effect that require local construction permits.

(W-1) Water Use Efficiency 1.4 $MMTCO_2E$

This measure identifies the potential for statewide water use efficiency improvement through implementation of individual i.e. per capita voluntary water conservation goals. The portion of energy efficiency savings obtained through water use efficiency while assumed under BAU and not additional is estimated as 5,150 GWh (approximately 16 percent of E-1) could be saved relative to increasing imports (not assumed under BAU). Avoiding 4,928 MW of electrical demand could avoid development of 513 to 49,280 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat. These energy savings and associated land resource benefits are assumed under BAU.

(W-2) Water Recycling 0.3 $MMTCO_2E$

This measure proposes to increase water supply reliability to meet increasing demand by recycling water in locations where the energy associated with recycling is less than the energy associated with transporting and treating additional imported water. Recycled water is used primarily for landscaping and industrial processes. Recycling water also produces waste products (the solids removed from wastewaters) and some of these waste products are processed to create “biosolids” which are used as soil conditioners or fertilizers in agricultural and landscaping applications. There are public concerns over the health impacts of exposure to

biosolids and they are regulated by multiple levels of government. In some California locations, certain applications of biosolids are banned.[73] Increasing water recycling increases the amount of biosolids produce that then require disposal.

The portion of energy efficiency savings obtained through water recycling while assumed under BAU and not additional is estimated as 1,250 GWh (approximately 4 percent of E-1). Avoiding 1,196 MW of electrical demand could avoid development of 124 to 11,960 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat. These energy savings and associated land resource benefits are assumed under BAU.

(W-3) Water System Energy Efficiency 2.0 MMTCO$_2$E

This measure proposes to reduce the magnitude and intensity of energy use associated with transport, treatment and delivery of water. Benefits or impacts to land resources are relative to reductions in energy use, but could also occur with physical changes to or additions of water infrastructure. Surface storage facilities would be the most land intensive feature of water infrastructure.

This measure proposes a target of 4,400 GWh electricity savings (approximately 14 percent of E-1). Avoiding 4,211 MW of electrical demand could avoid development of 439 to 42,110 acres. The avoided land use type could be developed land, agricultural lands, or natural habitat. Measure E-1 includes these energy savings and associated land resource effects.

(W-4) Reuse Urban Runoff 0.2 MMTCO$_2$E

This measure proposes to increase local surface and groundwater supplies by adopting stormwater management strategies, such as Low Impact Development (LID). LID increases infiltration in urban areas increasing regional stormwater capture and storage. Constructing neighborhood facilities to capture and reuse dry weather flows also increases local supply. These water supplies (270,000 - 333,000 acre-feet) can be used to avoid the need for new imported water supplies with higher energy-intensity. While the water and associated emission reductions generated by this measure are assumed under BAU i.e. not additional, avoiding the need to import new water supplies by reusing runoff avoids increased emissions that would otherwise be the case. The impacts of this measure on land resources will vary by type of action. Employment of Low Impact Development concepts could require variances to existing storm water management schemes. Constructing new facilities could require the conversion of land resources, which would be best evaluated on a project-level basis and through existing land use regulations and plans.

The portion of energy efficiency savings obtained through urban runoff reuse is estimated as 632 - 781 GWh (1 - 2 percent of E-1). Avoiding 605 – 747 MW of electrical demand could avoid development of 63 to 74,700 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat. The water and associated energy savings generated by this measure are assumed under BAU i.e. not additional.

[73] From information compiled on the California Integrated Waste Management Board website.

(W-5) Increase Renewable Energy Production 0.9 MMTCO$_2$E

This measure proposes to develop renewable energy projects on lands associated with California's state and local water infrastructure. The potential land impacts associated with these types of projects are evaluated in measure E-3.

The amount of renewable energy from this measure is estimated as 2,100 GWh (approximately 4 percent of E-3). Avoiding 2,010 MW of electrical demand could avoid development of 209 to 20,100 acres. This avoided land use type could be developed land, agricultural lands, or natural habitat. Measure E-3 includes these energy savings and associated land resource effects

(W-6) Public Goods Charge for Water TBD MMTCO$_2$E

This measure proposes to impose a monetary charge on water use and use resulting funds to reduce the GHG emissions from water-related energy use, as described in measures W-1 through W-5. Measures W-1 through W-5 are evaluated separately.

5. INDUSTRY

Regulatory Background

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Regarding land resources, the stationary source must comply with:

> **CEQA** requires proposed industrial facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. A Local, Regional, or State government agency serves as the lead or responsible agency for a CEQA document. Local, Regional, and State government agencies also both establish guidance for CEQA analyses and review documents for consistency with established plans and regulations. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.
>
> **Land Use/Zoning Laws** determine where industrial sources can be constructed and operated. New stationary sources have to obtain a local permit determining compliance with the **General Plan** and authorizing construction. If the proposed location is not within an approved land use area, the facility will have to undergo a public process to obtain a zone change, variance, or conditional use permit, dependent on the compatibility of the facility with the location. Land use permits require environmental review. There are also local building codes in effect that require local construction permits.

(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources TBD MMTCO$_2$E

This recommended measure focuses on improving efficiency at large industrial sources. It is anticipated that most efficiency improvements would take place on-site at existing industrial facilities, and would therefore not affect land resources.

(I-2) Oil and Gas Extraction GHG Emission Reduction 0.2 MMTCO$_2$E
(I-3) GHG Leak Reduction from Oil and Gas Transmission 0.9 MMTCO$_2$E

There are no anticipated changes to land use as a result of these measures.

(I-4) Refinery Flare Recovery Process Improvement 0.33 $MMTCO_2E$

(I-5) Removal of Methane Exemption from Existing Refinery Regulations

0.01 $MMTCO_2E$

There are no anticipated changes to land use as a result of these measures, as all changes would occur on land that is already developed.

6. RECYCLING AND WASTE MANAGEMENT

Regulatory Background

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Applicable regulations are described in the Industry Sector.

(RW-1) Landfill Methane Control Measure 1.0 $MMTCO_2E$

(RW-2) Additional Reductions in Landfill Methane: Increase the Efficiency of Landfill Methane Capture TBD $MMTCO_2E$

There are minimal anticipated changes to land use as a result of this measure, as they would either physically impact already disrupted land resources (retrofit existing landfills with gas collection systems), slightly change the footprint of planned disruptions to land resources (requiring new landfills to include gas collection systems), or improve the efficiency of existing gas collection systems.

(RW-3) High Recycling/Zero Waste 9 $MMTCO_2E$

Commercial Recycling recommends developing voluntary commercial recycling goals. Benefits to land resources are related to avoiding new landfills and to avoiding production of raw materials.

Increasing Production and Markets for Compost recommends halving the amount of organic material diverted to landfills by creating compost instead. This would require development of new facilities or expansion of existing facilities that produce compost. Siting can be difficult for these facilities because of the nature of their operations and their associated dust and odors. Some facilities are sited at a landfill site, which minimizes their potential individual impact. Land use impacts would be similar to siting of other facilities, and would be best evaluated on a project-level basis.

The **anaerobic digestion** of human, animal, or wet organic wastes reduces the physical amount of waste and improves the quality of the waste for disposal, requiring less land for disposal. Minimal land is required for construction of anaerobic digestion facilities.

Extended Producer Responsibility proposes to incorporate the costs of treatment and disposal into the total cost of a product. This should result in environmentally preferable products, as manufacturers seek to reduce overall product costs by minimizing treatment and disposal costs. **Environmentally Preferable Purchasing** would encourage the purchase of environmentally preferable products, products which use less energy, water, virgin materials and hazardous chemicals to produce. These measures intent is to reduce environmental impacts of product manufacturing. Because of the broad spectrum of products, and the geographical extent of extraction and manufacturing, it is not possible to specifically describe potential benefits to land

resources in California, although some of these benefits would be the reduced demand for landfills and reduced demand for virgin materials.

7. FORESTS

(F-1) Sustainable Forest Target 5 $MMTCO_2E$

This measure recommends establishing and implementing a target to sustain current levels of net carbon sequestration in the State's forests through maintenance of forest inventory and growth rates, reforesting areas lost to wildfires, and improving forest management to reduce the risk of wildfires in the state. Forestation provides many benefits to land resources, reducing the potential for topsoil erosion and landslides, and improving soil quality over deforested areas. Forests also provide valuable habitat, open space, and recreation areas which increase the quality of life for residents. The Sustainable Forest Target (F-1) would be implemented by the **California Board of Forestry and Fire Protection**, working with ARB**.** The Resources Agency and its departments will also have an important role to play in implementing this measure. Activities expected to occur to implement this measure must be evaluated in a functionally equivalent process to **CEQA**, which will ensure that potential impacts to land resources are examined.

8. HIGH GWP

Regulatory Background

Facilities that use refrigerants or make products containing refrigerants are regulated the same as the Industry sector. Waste products are regulated as described in the Recycling and Waste Management sector.

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing 0.26 $MMTCO_2E$

The primary purpose of this Discrete Early Action is to reduce the emissions of the high GWP gas HFC-134a from activities associated with DIY charging. It is not expected to affect land resources as it is not expected to affect the number of vehicles or of professional service shops.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications 0.3 $MMTCO_2E$

This Discrete Early Action measure will consider a potential ban on the use of SF_6 where technologically feasible and cost-effective alternatives are available, as well as a performance standard for other uses. The use of replacement gases is not expected to result in the need for new facilities or in the change of existing facilities; therefore, there are no land resource effects.

(H-3) High GWP Reduction in Semiconductor Manufacturing 0.15 $MMTCO_2E$

This measure recommends requiring manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce high GWP emissions from semiconductor manufacturing. These changes would occur on existing fabricator sites and would not affect land resources.

(H-4) Limit High GWP Use in Consumer Products 0.25 $MMTCO_2E$

The objective of this measure is to reduce the use of compounds in consumer products with high GWP when alternatives are available. These changes would occur on existing manufacturing sites and would not affect land resources.

(H-5) High GWP Reductions from Mobile Sources 3.3 $MMTCO_2E$

All of these measures recommend reducing leaks from refrigerant uses in stationary applications. These changes would not affect land resources because they would occur within existing commercial sites.

(H-6) High GWP Reductions from Stationary Sources 10.9 $MMTCO_2E$

Two measures are proposed as the **High GWP Stationary Equipment Refrigerant Management Program.** The **Refrigerant Tracking/Reporting/Repair/Deposit Program** measure recommends requiring commercial and public facilities with large stationary air conditioning and refrigeration equipment to minimize emissions of high GWP refrigerants through reporting, leak repair, improved servicing, and end-of-life control. The **Specifications for Commercial and Industrial Refrigeration Systems** measure proposes new specifications for commercial and industrial refrigeration systems to both reduce emissions of high GWP refrigerant and to increase energy efficiency of the units. These changes would occur on existing commercial and industrial sites and would not affect land resources.

Insulation foam that is diverted to landfills emits high GWP gases into the atmosphere. The **Foam Recovery and Destruction Program** measure recommends minimizing these emissions to as close to zero as possible by diverting waste foam away from landfills and destroying the foam at high temperatures, or by capturing the high-GWP GHGs within the foam and destroying the foam gas. This program would utilize existing facilities and would therefore not affect land resources.

The **SF_6 Leak Reduction and Recycling in Electrical Applications** measure recommends reducing emissions of SF_6 within the electric utility sector and at particle accelerators by requiring the use of best achievable control technology for the detection and repair of leaks, and the recycling of SF_6. Additionally, particle accelerator industry representatives are considering the use of possible substitute mediums. These changes would occur within existing facilities and would not affect land resources.

The **Alternative Suppressants in Fire Protection Systems** measure recommends evaluating the use of alternative suppressants in total flooding (fixed) and streaming (portable) fire suppression systems. The use of alternative suppressants is expected to have only minor operational impacts at existing commercial and residential sites; therefore, the measure would not affect land resources.

The **Residential Refrigeration Early Retirement Program** measure recommends partnering with existing voluntary programs to retire inefficient residential refrigeration appliances such as refrigerators and freezers. Appliance early retirement includes the recovery of high-GWP refrigerants and blowing agents for reclamation or destruction to avoid GHG emissions. This program would utilize existing facilities and would therefore not affect land resources.

(H-7) Mitigation Fee on High GWP Gases 5 $MMTCO_2E$

This measure recommends attaching a fee to the use of high GWP gases. This measure would support the goals and therefore have similar effects as Measures H-1 through H-6.

9. AGRICULTURE

Regulatory Background

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Applicable regulations are described in the Industry Sector.

(A-1) Methane Capture at Large Dairies 1.0 $MMTCO_2E$

Methane from dairy manure can be captured through the installation and use of anaerobic digesters. This measure recommends installing anaerobic digesters on new and existing dairies, 89 percent of which are located in the Central Valley. Anaerobic digesters may not be compatible with agricultural land uses or Williamson Act contracts. New digesters would go through environmental review and permitting for compatibility with existing land resources.

10. SUMMARY

Measures recommended by the Scoping Plan interact with land resources in several ways. Regional transportation-related GHG targets and Green Building principles have the potential to reduce the impact of urban development and reduce the potential for conversion of agricultural lands and open spaces. Renewable energy resources have the potential to use more land mass to generate electricity, but some types of renewables have fewer overall environmental impacts than traditional natural gas and coal. New facilities constructed to serve alternative fuel demands will also require land resources. Regulatory development could encourage the appropriate siting of any new facilities within appropriate zoning areas and in compliance with ARB's Land Use Handbook principles.

Locally, new construction or modifications would comply with local land use regulations and permitting obligations. Development of a High Speed Rail line through California should be pursued in a way that minimizes the potential for conversion of existing agricultural lands and that encourages Smart Growth and Green Building principles.

C. WATER RESOURCES

Surface water quality around the state qualifies as impaired under the Clean Water Act. Population trends will add to these stresses by adding demand for water supplies, food supplies, and wastewater services. Development creates impervious surfaces which contribute to flood and water quality problems. Development in flood plains exacerbates flooding and increases the risk of property damage and loss of life.

Regulatory Background

Water resources, both supply and quality, are regulated at both the federal and state levels. Federal Laws and Regulations include:

The **Clean Water Act** (33 U.S.C. §1251 et seq.) serves to protect the nation's surface waters. As part of the Clean Water Act, the federal government develops water quality standards to protect aquatic and human life (including recreational use) which are enforced by the state. The state then identifies surface waters that do not meet standards, prioritize their remedies, and develop mass-based loading programs to improve water quality (§303, Total Maximum Daily Load program). The federal government also certifies that projects will not impair water quality (§404) and requires that waters discharged into surface waters meet prescribed standards (National Pollutant Discharge Elimination Source program).

Section 10 of the **Rivers and Harbors Act** (33 U.S.C. §401 et seq.) protects navigable rivers and harbors, requiring federal permits to make physical changes.

State Laws and Regulations include:

The California Department of Fish and Game Code (§1601–1603 [**Streambed Alteration**]) protects aquatic species by requiring a state permit to physically alter stream or lake beds or banks.

The **Porter-Cologne Water Quality Act** (Water Code §13000 et seq.) authorizes the state to implement the Clean Water Act in California.

Cobey-Alquist Flood Plain Management Act (Water Code §8400 et seq.) authorizes the Board that directs state flood control activities and requires permits for encroachments in known flood plains to minimize flood impacts.

A mix of local governments, special districts, and private companies provide water and wastewater services in California. These service providers have their own process for determining how new demands for water or wastewater services can or should be provided. **Senate Bills 610 and 221 (2001)** require development projects to demonstrate that water is available to reliably support the project.

Evaluation Process

Where possible, existing studies, environmental documentation, and regulatory documentation for measures were reviewed for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was

available, ARB consulted experts at state agencies, including at ARB and Climate Action Team agencies. More detailed information about the proposed regulations and the measures under evaluation is provided in Appendix C of the Scoping Plan, as well as in the discussion of the potential impact on air resources.

1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE

The recommended measure is not expected to have any adverse impacts on water resources. Instead, we expect the declining cap to incentivize utilities to promote local conservation programs to reduce water demand and wastewater discharge. These programs would in turn reduce load demand on public utilities that would otherwise provide electricity for pumping and treatment.

2. TRANSPORTATION

(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards 31.7 $MMTCO_2E$
Feebates – In-lieu of Pavley Regulations 31.7 $MMTCO_2E$
(T-4) Vehicle Efficiency Measures 4.5 $MMTCO_2E$

At times, the refining, marketing and distribution of gasoline adversely affects water quality due to leaks, spills, and wastewater discharge. Any reduction in fuel use would reduce the opportunity for such occurrences. Consequently, ARB staff projects that the proposed measure would likely have a positive impact on water quality.

(T-2) Low Carbon Fuel Standard 15 $MMTCO_2E$

For this evaluation, ARB compared the potential water resources effects of the LCFS to traditional petroleum fuels. Refinement of crude oil in California consumes 1.5 gallons of water per gallon of gasoline produced.[74] Crude oil is imported from foreign sources (45 percent), Alaska (16 percent), and in-state sources. The two largest uses of water associated with oil production are for drilling and for enhanced recovery. Drilling for crude oil does require water use to form drilling muds, which are used to lift drill cuttings to the surface. These muds contain fine clays, which are often not allowed to be disposed of directly in surface waters, and require treatment prior to disposal. Some crude oils are too heavy to flow, so steam is injected in the vicinity to thin the oil – an enhanced recovery process requiring both water and energy.

The majority of the potential LCFS pathways are evaluated below. The electrification pathway (plug-in electric vehicles) is addressed in the energy section, under the proposed RPS measure.

Biofuels: Water use at biorefineries can vary. Fermentation requires water for hydrolysis, fermentation, and distillation processes, currently around 4 gallons of water consumed per gallon of ethanol produced.[75] Cellulosic feedstocks are broken down with enzyme additions prior to fermentation, generally more water intensive on the whole, but projected to actually consume 2 to 6 gallons of water per gallon of ethanol produced.[76] Biodiesel refining is the least water intensive, consuming around 1 gallon of water per gallon of biodiesel produced.[77] Also, wastewater from biorefineries can contain high levels of biological oxygen demand (BOD)

[74] Pate, R., M.Hightower, C.Cameron, and W.Einfeld,. *Overview of Energy-Water Interdependencies and the Emerging Energy Demands on Water Resource,*. Report SAND 2007-1349C, Los Alamos, NM: Sandia National Laboratories, 2007.
[75] Ibid.
[76] Ibid.
[77] Ibid.

grease and salts. Some facilities in the Midwest have been cited for breaching the limits allowed under the National Pollutant Discharge Elimination System permits the facilities are required to hold.

But the greatest potential impact on water resources by biofuels is the production of feedstock. Agriculture in the United States relies on a mixture of natural rainfall and irrigation, the ratio of which depends on the local climate. Irrigation practices can have a very large effect on the overall water consumption by biofuels. Just as irrigation water demand is highly dependent on location, so is the impact of that water demand. In addition to water demand, the chemicals and fertilizers used on these crops can end up in surface or ground waters, effecting water quality. These issues will be further discussed in the LCFS regulatory development.

The location of these water demands determines their ultimate effect. In the Midwest, where much of the corn and soy beans are grown, historic overdraw of groundwater resources and high organic loading of surface waters would suggest that the additional water demand of biofuel production and increase nitrogen loading of feedstock production could impact existing water resources.

Hydrogen: Hydrogen fuel can be created from water (through electrolysis) or from hydrocarbon sources such as natural gas, methanol, or petroleum products (steam reforming). Steam reformation of natural gas is the most common form of hydrogen production in the United States.[78] Each of these processes uses water: in electrolysis energy is used to break apart water bonds to create hydrogen, in reforming steam is used to break apart hydrocarbon bonds. The consumptive water resource requirements for these processes are not well documented, but given the pressures on California's water supplies, these requirements should be quantified within the LCFS regulatory process or within the siting process for hydrogen production facilities.

(T-5) Ship Electrification at Ports 0.2 MMTCO_2E

(T-6) Goods Movement Efficiency Measures 3.5 MMTCO_2E

At times, the refining, marketing and distribution of diesel and gasoline adversely affects water quality due to leaks, spills, and wastewater discharge. Any reduction in fuel use would reduce the opportunity for such occurrences. Consequently, the recommended goods movement measures that result in reduced fuel consumption would have a positive impact on water quality. Redirected effects due to electrification are addressed in the energy section.

One maintenance practice to be considered in the commercial harbor craft measure is the use of anti-fouling products on the hulls to improve hull smoothness. The active ingredient of a number of anti-fouling products is copper. The copper is slowly leached out of the product and thereby inhibits the growth of species that foul vessel hulls. The potential adverse impacts are associated with the leached copper, particularly in harbors and marinas that are relatively shallow and experience a reduced level of water circulation. The use of anti-fouling products containing copper could negatively impact water quality. ARB staff would promote the use of non-toxic anti-fouling products by vessel owner/operators and educate them about the dangers associated with other products. With non-toxic products, a vessel owner/operator would have to clean the hull more frequently than if they were to use copper-based anti-fouling products. However, non-toxic products do not need to be reapplied as often as copper-based products.

[78] U.S. Department of Energy. http://www1.eere.energy.gov/hydrogenandfuelcells/education/basics_production.html

(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency 0.93 $MMTCO_2E$

(T-8) Medium and Heavy-Duty Vehicle Hybridization 0.5 $MMTCO_2E$

There are no anticipated changes to land use as a result of measures T-6 and T-8, as these measures would not affect the total number of vehicles in the state or the overall use of fuel. Measure T-7, however, is anticipated to result in 48 million gallons of avoided diesel use. This would have upstream impacts on water quality similar to measures T-1 and T-3.

(T-3) Regional Transportation-Related Greenhouse Gas Targets 5 $MMTCO_2E$

Under this measure ARB would work with MPOs to establish passenger vehicle greenhouse gas emission reduction targets (regional targets) for 2020 and 2035. The specific water resource impacts of particular land use and transportation strategies applied to implement this measure would be evaluated under existing applicable regulatory structures as they are triggered, including CEQA. Generally, this measure encourages more compact development patterns and reduced vehicle use. In so far as compact development patterns reduce traditional large lot development patterns, this measure has the potential to significantly reduce water demand from landscaping, as well as reduce future degradation of surface water quality associated with impervious surfaces. Reductions in vehicle use from this measure could also have water resource benefits similar to measures T-1 and T-3, due to avoided fuel use.

(T-9) High Speed Rail 1 $MMTCO_2E$

The Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its water resources analysis. The programmatic EIR/EIS examined the impacts of the High Speed Rail on existing water resources. The impacts are typical of a large-scale infrastructure project, and would have to minimize and mitigate impacts in order to obtain appropriate approvals and permits. Impacts would be less than those associated with an equivalent expansion of highway infrastructure.

3. ELECTRICITY AND NATURAL GAS

Electricity and water are intricately linked in California. Many forms of electricity production require water for steam generation or cooling or use water resources directly as in hydropower and geothermal projects. As water resources are limited in California, technological advances have optimized and minimized water use. Electricity is also used to power the state's water system – transporting water from its source to where it is used, and for heating water for residential, commercial, and industrial uses. The measures recommended in the Scoping Plan for the electricity sector were analyzed for direct and indirect effect on water resources, but electricity savings were not translated into water savings. It is possible that electricity savings will result in water savings, but ARB did not quantify these potential savings.

Regulatory Background

For large energy facilities, the **CEC Certification process** serves as an equivalent to the otherwise required state and local permitting requirements. The CEC has authority to certify (permit) the construction and operation of thermal electric power plants 50 megawatts or larger and all related facilities. The site certification process provides a review and analysis of all aspects of a proposed project, including water supply availability and wastewater impacts, equivalent to the CEQA process. The process is also a public process. Smaller facilities with no

potentially significant environmental impacts can apply for an exemption process, similar to a mitigated negative declaration approach under CEQA.

The CEC works with local governments to ensure a functionally equivalent permitting process. CEC prepare the necessary evaluation in a "Preliminary Staff Assessment", working with the local government to ensure it provides the information needed for the local and state governments to approve the project and either serves as the appropriate permit or basis for the appropriate permit.

SWRCB's "**Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling**" (Order No. 75-58) encourages the use of alternative sources of cooling water and/or the use of alternative cooling technology. Alternative sources of cooling water identified in the policy include wastewater, irrigation return flows, and naturally brackish water. The policy also encourages the evaluation of dry or wet/dry cooling technology for those facilities that may require water from the Sacramento-San Joaquin River Delta.

(E-1) Energy Efficiency (Electricity) 15.2 MMTCO$_2$E
(CR-1) Energy Efficiency (Natural Gas0 4.3 MMTCO$_2$E

The California Energy Commission has authority to set efficiency standards for appliances and buildings that include water. Some types of appliance achieve their energy savings partially through reducing the amount of water used, such as washing machines and dishwaters, which are significant contributors to household water demand; some appliances are also used in commercial settings. These types of measures, provided the water-energy linkage continues to hold, are more likely to reduce water use than to increase it.

Water efficiency and conservation can also result in energy efficiency and conservation, lowering the need for energy to heat or cool water, or electricity to move water. Decreases in fossil-fired electricity use could slightly decrease demand for water associated with fossil-fired electricity production. Reductions in water demand can reduce the electricity associated with the transport, treatment and delivery of water.

(CR-2) Solar Water Heating 0.1 MMTCO$_2$E

These measures are expected to have minimal effect on water resources. Although photovoltaic systems require periodic washing, the impact on water resources is expected to be very small.

(E-4) Million Solar Roofs 2.1 MMTCO$_2$E

These measures are expected to have minimal effect on water resources. Although photovoltaic systems require periodic washing, the impact on water resources is expected to be very small. Decreases in fossil-fired electricity use could slightly decrease demand for water associated with fossil-fired electricity production.

(E-2) Increase Combined Heat and Power 6.7 MMTCO$_2$E

The potential impacts on water resources from this recommended measure depends on the technology(ies) deployed. If a combined heat and power system, including its air pollution control technologies, is more efficient than the electricity source it is replacing, water use could decrease. It is not possible to quantify this effect, but ARB recommends that the potential water resource impacts be considered in development of this measure.

(E-3) Renewables Portfolio Standard 21.3 MMTCO$_2$E

This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. This requirement could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons the benefits and impacts of each renewable resources are evaluated relative to natural gas, and are not individually quantified for potential air emissions.

Water use for energy production is trending away from freshwater resources and toward recycled water or air cooling processes. Wastewater is also transitioning from surface water disposal towards disposal to municipal wastewater facilities or the elimination of wastewater altogether. For comparison purposes, the 2007 Environmental Performance Report examined water use by plant type and cooling system. Combined-Cycle natural gas plants with re-circulating wet cooling consume 676 to 1,380 gallons per MWh. Dry cooling reduces water use to 50 to 180 gallons per MWh. Peaking plants are generally simple-cycle plants with inlet cooling, and consume 80-600 gallons per MWh. Renewable sources (except hydropower) are generally within or less than the range of combined-cycle natural gas plants with recirculated cooling.

Wind power does not have any associated water use.

Solar thermal plants can be wet or dry cooled. Parabolic trough plants consume 960 to 1,120 gallons per MWh (similar to a wet cooled natural gas plant), while sterling engines consume 4 to 6 gallons per MWh, mostly for mirror washing. Porous surfaces in the project area minimize impacts on surface water storm flows. Solar **photovoltaic** plants require periodic washing but do not require cooling.

Biomass (forest or agricultural residuals) may use water to clean materials prior to combustion. Other water requirements are similar to wet cooled natural gas-fueled plants, 760 to 1,170 gallons per MWh.

The **anaerobic digestion** of human, animal, or wet organic wastes (including wastewaters) may produce a gas with 50 to 80 percent methane (biogas) that can be combusted to produce electricity. Wastewaters are regulated by SWRCB and Regional Water Quality Control Boards to ensure they do not impair surface water or groundwater. Digester projects may need to obtain waste discharge requirements for wastewater discharge if the discharge is not already subject to the permit for a wastewater treatment facility.

Landfill gas (mostly methane) plants using simple-cycle engines consume 80 to 830 gallons per MWh, whereas reciprocating engines consume less than 1 gallon per MWh. Both engines are currently in use, but are both less consumptive than wet cooled natural gas-fueled plants. In the future, use of reciprocating engines should be encouraged to minimize water resource impacts.

Geothermal sources of energy production rely on hot waters and concentrated steams that tend to have high mineral contents. These waters are used to create thermal power and then re-injected into the ground, consuming 8 to 30 gallons per MWh. Geothermal wells are designed to minimize impacts on nearby water resources. Monitoring is usually required to ensure there are no water quality impacts on nearby surface or ground waters.

Small **hydropower** projects are used in locations where water resources are already disturbed. They do not consume additional water resources, impair water quality, or create waste waters.

4. WATER

Regulatory Background

Water infrastructure includes reservoirs, dams, canals, aqueducts, pipelines, pumping stations, and water treatment plants. Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Regarding water resources, new water infrastructure must comply with:

> Water regulated by the state requires a **water right**, which is a lengthy public application process that requires CEQA compliance.
> **CEQA** requires proposed new facilities or significant changes to existing facilities or water operations to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. Water infrastructure is typically constructed by a local, regional, or state government agencies working with other local, regional, or state government agencies to determine who will serve as the lead or responsible agency for a CEQA document. Local, Regional, and State government agencies also both establish guidance for CEQA analyses and review documents for consistency with established plans and regulations. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.

(W-1) Water Use Efficiency 1.4 $MMTCO_2E$

This measure identifies the potential for statewide water use efficiency improvement through implementation of individual i.e. per capita voluntary water conservation goals. Increasing statewide, total water demand can be met through individual end use efficiency improvements (appliances and fixtures that use less water than existing appliances and fixtures) and through individual water conservation (changes to behavior and practices). Water demand is expected to grow under the BAU scenario, but it is not clear precisely what the net change in water demand will be in 2020. Water use efficiency and water conservation will be critical and economical tools for meeting California's diverse water demands in the future. Water conservation can also "harden" water demands, allowing less room for rationing while meeting public health and economic thresholds during extended droughts. Water conservation can also allow for growth of urbanization and development, and the impacts associated with that growth.

(W-2) Water Recycling 0.3 $MMTCO_2E$

This measure proposes to increase water supply reliability to meet increasing demand by recycling water in locations where the energy associated with recycling is less than the energy associated with transporting and treating water. The displacement of 0.37 MAF of new imported water supplies by recycled water supplies would then result in a net energy and water savings. Recycled water is used primarily for landscaping and industrial processes, and is water that would otherwise need to be disposed of, most frequently to a surface water or ocean water. Redirecting this discharge can have positive impacts on receiving water quality.

(W-3) Water System Energy Efficiency 2.0 $MMTCO_2E$

This measure proposes to reduce the amount of energy used to transport, treat and deliver water. ARB expects that this measure will have little to no impact on water resources. Any projects that

have the potential to impact water supply or quality would be subject to CEQA and other permitting requirements.

(W-4) Reuse Urban Runoff 0.2 MMTCO$_2$E

This measure proposes to increase local surface and groundwater supplies by adopting stormwater management strategies, such as Low Impact Development (LID). LID increases infiltration in urban areas increasing regional stormwater capture and storage. Constructing neighborhood facilities to capture and reuse dry weather flows also increases local supply. These water supplies (270,000 - 333,000 acre-feet) can be used to avoid the need for new imported water supplies with higher energy-intensity. These types of actions have the potential to either impact or benefit water resources. Increasing infiltration and capturing dry weather flows can benefit surface waters by reducing diversions, but they can also interrupt the recharge of ground and surface waters. The timing and magnitude of these projects will determine their potential effects on water resources (quantity and quality), and they should be examined and minimized or mitigated on a project by project basis. Recharging ground water basins with urban storm water can also have water quality impacts.

(W-5) Increase Renewable Energy Production 0.9 MMTCO$_2$E

This measure proposes to develop renewable energy projects on lands associated with California's state and local water infrastructure. The potential water impacts associated with these types of projects are evaluated in measure E-3.

(W-6) Public Goods Charge for Water TBD MMTCO$_2$E

This measure proposes to impose a monetary charge on water use and use resulting funds to reduce the GHG emissions from water-related energy use, as described in measures W-1 through W-5. Measures W-1 through W-5 are evaluated separately.

5. INDUSTRY

Regulatory Background

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. For water supply, water quality and wastewater, the stationary source must comply with the following:

> To obtain water service, applications are made to the appropriate local water provider or the SWRCB. Depending on the site location, water supply from groundwater may be obtained through well construction. A permit from a local agency is required for well construction. Water administered by a local agency may be obtained through an application process which may or may not require an environmental review. It may also require the facility to prove it meets a specified degree of water conservation. Water regulated by the state requires a **water right**, which is a lengthy public application process that requires CEQA compliance.
> In general, any person responsible for the discharge of waste that could affect the quality of waters of the state that is not discharged to a community sewer system is required to submit a technical report of the discharge to the appropriate **Regional Water Quality Control Board (RWQCB)**. RWQCBs typically prescribe waste discharge requirements (i.e., a "permit") that reflect the nature of any proposed, existing, or material change to an existing discharge. Prescribed requirements must implement the relevant adopted water quality

control plan (i.e., "Basin Plans"). In some cases, RWQCB may "waive" adoption of waste discharge requirements. Such a waiver can only occur when either a specific discharge or type of discharge is consistent with the applicable water quality control plan and such a waiver is in the public interest.

For discharges to a community sewer system, applications are made to the appropriate local wastewater collection (sewer system) and treatment agency. Local wastewater services may require an engineering analysis to support issuance of a **permit to discharge** into the community sewer system.[79] Wastewater discharges from commercial, institutional, and industrial facilities may also be subject to a local agency's wastewater **Pretreatment Program**, which may require additional onsite pre-treatment of industrial wastewaters. Facilities with **Zero-Discharge Waste** systems may also have to obtain a local permit. Facilities that wish to discharge wastewater directly into surface waters must comply with the **National Pollutant Discharge Elimination System (NPDES)** permits issued by a RWQCB. In general, an NPDES permit prescribes discharge requirements that restrict the magnitude and quality of discharges to avoid degradation of the receiving surface water body as necessary to ensure the protection of beneficial uses of water.

Depending on the scale and nature of water and wastewater associated with a facility, waste discharge requirements may incorporate mitigation measures identified in a **CEQA** analysis. CEQA requires proposed industrial facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. A Local, Regional, or State government agency serves as the lead or responsible agency for a CEQA document. Local, Regional, and State government agencies also both establish guidance for CEQA analyses and review documents for consistency with established plans and regulations. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.

(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources TBD $MMTCO_2E$

This measure is not anticipated to affect water resources, unless measures are identified and implemented that improve energy efficiency through improving water use efficiency.

(I-2) Oil and Gas Extraction GHG Emission Reduction 0.2 $MMTCO_2E$
(I-3) GHG Leak Reduction from Oil and Gas Transmission 0.9 $MMTCO_2E$

These measures are not anticipated to affect water resources, as they address fugitive air emissions.

(I-4) Refinery Flare Recovery Process Improvements 0.33 $MMTCO_2E$

This measure is not anticipated to affect water resources.

[79] In this case, the municipal wastewater treatment plant is the holder of the state permit to discharge to surface waters.

(I-5) Removal of Methane Exemption from Existing Refinery Regulations 0.01 MMTCO$_2$E

This measure would not affect water resources, as methane is an air emission.

6. RECYCLING AND WASTE MANAGEMENT

Regulatory Background

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. Applicable regulations are described in the Industry Sector.

(RW-1) Landfill Methane Control Measure 1.0 MMTCO$_2$E

Landfills are managed to protect the beneficial uses of the waters of the state. Anaerobic decomposition of organic wastes creates byproducts of gaseous methane and carbon dioxide, plus trace gas constituents. Landfill gas collection systems are partially regulated by the RWQCB, as condensate in collection tanks must be collected and properly disposed of (onsite or through municipal wastewater treatment). In addition, the RWQCB requires monitoring of such systems to ensure the protection of beneficial uses of groundwater. Measure RW-1, also a discrete early action, proposes to require collection and control of methane emissions from uncontrolled MSW landfills without landfill gas collection systems and establish statewide standards for the gas collection and control system, including methane destruction efficiency requirements and landfill methane surface emission standards, for all landfills. While this would increase the amount of condensate generated, existing regulations ensure it would be properly disposed of and would therefore not affect water resources.

(RW-2) Additional Reductions in Landfill Methane: Increase the Efficiency of Landfill Methane Capture TBD MMTCO$_2$E

This measure is not anticipated to affect water resources, as this measure proposes to develop best management practices and standards to minimize fugitive methane emissions.

(RW-3) High Recycling/Zero Waste 9 MMTCO$_2$E

Commercial Recycling recommends developing voluntary commercial recycling goals. Benefits to water resources are related to avoiding new landfills and to avoiding production of raw materials.

Increasing Production and Markets for Compost recommends halving the amount of organic material diverted to landfills by creating compost instead. This would require development of new facilities or expansion of existing facilities that produce compost. Other alternatives for organic material diversion from landfills may have consequences or unknown risks to the environment such as water quality impacts. Landfills provide a specified level of protection for waste, such as leachate collection and removal systems, liners and/or groundwater monitoring networks that can detect releases. Compost facilities can produce a leachate that must be collected and appropriately treated to protect water quality and the environment. RWQCBs can issue conditional waivers in lieu of prescribing waste discharge requirements which described operational ways reduce the potential threat to water quality; otherwise the leachate could be subject to permit conditions to protect water quality.
Application of composted materials to agricultural and urban landscapes may increase water retention within the soil profile thereby reducing the water demands, reducing the demand for California's water supplies and resources.

The **anaerobic digestion** of human, animal, or wet organic wastes (including wastewaters) may produce a gas with 50 to 80 percent methane (biogas) that can be combusted to produce electricity. Wastewaters are regulated by SWRCB and RWQCBs to ensure they do not impair surface water or groundwater. Digester projects may need to obtain waste discharge requirements for wastewater discharge if the discharge is not already subject to the permit for a wastewater treatment facility.

Extended Producer Responsibility proposes to incorporate the costs of treatment and disposal into the total cost of a product. This should effectively result in environmentally preferable products, as manufacturers seek to reduce overall product costs by minimizing treatment and disposal costs. **Environmentally Preferable Purchasing** would encourage the purchase of environmentally preferable products, products which use less energy, water, virgin materials and hazardous chemicals to produce. These measures intent is to reduce environmental impacts of product manufacturing. Because of the broad spectrum of products, and the geographical extent of extraction and manufacturing, it is not possible to specifically describe potential benefits to water resources in California, although some of these benefits would be the reduced demand for landfills and reduced demand for virgin materials.

7. FORESTS

(F-1) Sustainable Forest Target 5 MMTCO$_2$E

This measure recommends establishing and implementing a target to sustain current levels of net carbon sequestration in the Forest sector with actions such as reforesting areas lost to wildfires and improving forest management to reduce the risk of catastrophic wildfires in the state. Deforestation from wildfires or overharvesting can have negative impacts on water quality, particularly by introducing silt and organic carbon into surface waters. Silt and organic carbon can change water chemistry and affect water quality. If the measure includes pesticide applications, it would be further analyzed for impacts to water resources. Forests can serve as "filters" to improve water quality entering groundwater basins and surface waters, and play an important role in the hydrologic cycle, removing contaminants from air before they can enter the water phase. Activities expected to occur to implement this measure must be evaluated in a functionally equivalent process to **CEQA**, which will ensure that potential impacts to land resources are examined.

8. HIGH GWP

Regulatory Background

Facilities that use refrigerants or make products containing refrigerants are regulated the same as the Industry sector. Waste products are regulated as described in the Recycling and Waste Management sector.

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing 0.26 MMTCO$_2$E

The primary purpose of this Discrete Early Action is to reduce the emissions of the high GWP gas HFC-134a from activities associated with DIY charging. It is not expected to affect water resources as leaks do not affect water resources and their reduction will not affect the number or operation of vehicles or professional service shops.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications 0.3 $MMTCO_2E$

This Discrete Early Action measure will consider a potential ban on the use of SF_6 where technologically feasible and cost-effective alternatives are available, as well as a performance standard for other uses. The use of SF_6 or its replacement gases do not interact with water resources, and the manufacture of replacement gases is not expected to affect water resources.

(H-3) High GWP Reduction in Semiconductor Manufacturing 0.15 $MMTCO_2E$

This measure recommends requiring manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce high GWP emissions from semiconductor manufacturing. These changes would occur within existing fabricator processes and would not affect water resources.

(H-4) Limit High GWP Use in Consumer Products 0.25 $MMTCO_2E$

The objective of this measure is to reduce the use of compounds in consumer products with high GWP when alternatives are available. These changes would occur on existing manufacturing sites and would not affect water resources.

(H-5) High GWP Reductions from Mobile Sources 3.3 $MMTCO_2E$

Each of these measures recommends ways to reduce leaks from refrigerant uses in mobile applications. These changes would not affect water resources because liquid refrigerants evaporate quickly at room temperature.

(H-6) High GWP Reductions from Stationary Sources 10.9 $MMTCO_2E$

Each of these measures recommends ways to reduce leaks from refrigerant uses in stationary applications. These changes would not affect water resources because liquid refrigerants evaporate quickly at room temperature.

(H-7) Mitigation Fee on High GWP Gases 5 $MMTCO_2E$

This measure recommends attaching a fee to the use of high GWP gases. This measure would support the goals and therefore have similar effects as Measures H-1 through H-6.

9. AGRICULTURE

Regulatory Background

Before a digester can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. The majority of dairies that are potentially affected by this measure are located in the Central Valley, where they rely on either underlying groundwater or purchased contract water through Irrigation Districts. Dairy wastewater management is regulated by the applicable RWQCB, which will generally require a **Waste Discharge Requirement (WDR)**, dictating how wastewater on the site will be managed. The WDR will require a **CEQA** review.

(A-1) Methane Capture at Large Dairies 1.0 $MMTCO_2E$

Methane from dairy manure can be captured through the installation and use of anaerobic digesters. This measure recommends installing anaerobic digesters on new and existing dairies, 89 percent of which are located in the Central Valley. Anaerobic digestion produces both liquid and solid wastes. Liquid wastes are generally added to existing dairy manure ponds, and

managed to meet the water quality management requirements prescribed by a WDR for the system. WDRs ensure that water resources are not impacted.

10. SUMMARY

Recommended measures within the Scoping Plan would not substantially benefit or impact statewide water resources. Reducing the use of fossil-fuels reduces the use of water in extraction and refining processes, as well as reducing risks of water body contamination during transportation. Smart growth principles encourage reducing development impacts on water resources. Water use efficiency and conservation measures were accounted for in the Business As Usual Scenario. All of the sectors described interact with water in some way, and some contribute to existing water quality problems (NOx deposition from cooling towers, nitrogen runoff from agriculture). In many cases, actions to reduce GHGs will also reduce potential water pollutants. Many of the measures will require further evaluation of water resource effects within their regulatory development.

Construction activities and facilities that either use raw water or produce waste water will have to comply with existing regulations to minimize impacts to water resources.

D. NATIVE SPECIES AND BIOLOGICAL RESOURCES

Currently there are 58 species on the endangered list in California. A growing population and associated development will also continue to stress California's native species and biological resources, by removing or impairing habitat, or severing habitat corridors. By 2020 several listed or endangered species have the potential to become extinct due to the continued degradation of the natural system. Pressures from population growth come from the development of land for population support infrastructure, the overharvesting of food species, the introduction of invasive species and predation by household pets, and other disturbances to natural features, like the alteration of stream flows.

The Attorney General suggested that it is difficult to provide a general statement regarding the impacts the changing climate has on the state's varied ecosystems. It is clear that rising temperatures, altered water supplies, and other environmental variations make some habitats less hospitable for sensitive plants and animals.

Regulatory Background

Native species and biological resources include native and introduced aquatic and terrestrial species, plants, and their habitats. Biological resources are regulated at both federal and state levels, and many water resource regulations also protect biological resources. These regulations help protect and recover resources, by requiring special review and permits of actions that may impact those resources.

Federal Laws and Regulations include:

> The **Endangered Species Act (ESA)** (16 U.S.C. 1531–1543) established a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The U.S. Fish and Wildlife Service (FWS) of the Department of the Interior maintains a worldwide list which includes 1574 endangered species (599 are plants) and 351 threatened species (148 are plants). Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees. The law requires federal agencies, in consultation with FWS and/or the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife.[80]
>
> The **Fish and Wildlife Coordination Act** (16 U.S.C. 661–666) requires government agencies to consult with FWS prior to modifying the waters or channel of a body of water, with a view to the conservation of wildlife resources. The Act also authorizes land and water acquisition by federal construction agencies for wildlife conservation and development.

[80] http://www.epa.gov/lawsregs/laws/esa.html

The **Coastal Zone Management Act** (16 U.S.C. 1456) establishes federal programs for the management of the nation's coastal resources and the Great Lakes in order to balance economic development with environmental conservation, and for the study of human influences on estuaries. The programs are administered by NOAA's Office of Ocean and Coastal Resource Management (OCRM).

State Laws and Regulations include:

The **California Endangered Species Act (CESA)** (Fish and Game Code §2050 et seq.) was enacted to protect or preserve all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation. The Department of Fish and Game (DFG) is charged with enforcing the Act and with issuing permits authorizing incidental "take" to otherwise lawful development projects.

The **Native Plant Protection Act** (Fish and Game Code §1900–1913) was enacted to preserve, protect and enhance endangered or rare native plants of this state. Habitats are threatened with destruction, drastic modification, or severe curtailment, or because of commercial exploitation or by other means, or because of disease or other factors. DFG maintains a list of protected plants and negotiates agreements to protect threatened plants.

The **Natural Community Conservation Planning Act** (Fish and Game Code §2800 et seq.) expands the Endangered Species Act to conserve natural communities at the ecosystem scale while accommodating compatible land use. The program seeks to anticipate and prevent the controversies and gridlock caused by species' listings by focusing on the long-term stability of wildlife and plant communities and including key interests in the process. This program is implemented by DFG.

The **California Coastal Act** (Public Resources Code §30000, et seq.) is California's version of the federal Coastal Zone Management Act. To protect California's coastal resources, the California Coastal Commission reviews all proposed construction in the defined coastal zone.

Process of Evaluation

Where possible, existing studies, environmental documentation, and regulatory documentation for measures were reviewed for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was available, ARB consulted experts at State agencies, including ARB and Climate Action Team agencies. More detailed information about the proposed regulations and the measures under evaluation is provided in Appendix C of the Scoping Plan, as well as in the discussion of the potential impact on air resources.

1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE

No direct impacts from the recommended measure were identified at this time that could adversely affect plant or animal species or the resources on which they rely as a result of a compliance-based trading program that complies with AB 32 requirements. Indirect impacts of this proposed measure would be evaluated as part of the rule development process.

2. TRANSPORTATION

(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards 31.7 $MMTCO_2E$
Feebates – In-lieu of Pavley Regulations 31.7 $MMTCO_2E$
(T-4) Vehicle Efficiency Measures 4.5 $MMTCO_2E$

At times, the refining, marketing and distribution of gasoline adversely affects water quality due to leaks, spills, and wastewater discharge. These water quality impacts can also impair important habitat, or interfere with critical life-cycles of native species. Any reduction in fuel use would reduce the opportunity for such occurrences. Consequently, ARB staff projects that the proposed measures could have a positive impact on biological resources.

(T-2) Low Carbon Fuel Standard 15 $MMTCO_2E$

At times, the refining, marketing and distribution of petroleum fuels adversely affects water quality due to leaks, spills, and wastewater discharge. These water quality impacts can also impair important habitat, or interfere with critical life-cycles of native species. Any reduction in petroleum fuel use would reduce the opportunity for such occurrences.

Some biofuels feedstocks have the potential to affect native species and biological resources, if feedstocks are produced though conversion of important habitat to agriculture or increase agricultural activities in species' corridors.

Hydrogen production and use should have little or no affect on native species and biological resources outside of any potential effects from its energy and water source.

(T-5) Ship Electrification at Ports 0.2 $MMTCO_2E$
(T-6) Goods Movement Efficiency Measures 3.5 $MMTCO_2E$

Ports affect the coastal and ocean environments, intersecting with shallow aquatic habitat and species, pelagic species including migrating mammals, and bird species. Some of these species are endangered or threatened. Species and habitats can be impacted by physical activity within or changes to their habitat, water quality degradation through wastes and accidental discharges, and through the introduction of invasive species by international vessels. Ports regularly undertake programmatic and project-level CEQA documentation for their proposed activities, and many coastal environments in California have special environmental regulations and oversight.

One maintenance practice to be considered in the commercial harbor craft measure is the use of anti-fouling products on hulls to improve hull smoothness. The active ingredient of a number of anti-fouling products is copper. The copper is slowly leached out of the product and thereby inhibits the growth of species that foul vessel hulls. The potential adverse impacts to biological resources are associated with the leached copper, particularly in harbors and marinas that are relatively shallow and experience a reduced level of water circulation. The use of anti-fouling products containing copper could negatively impact biological resources. ARB staff would

promote the use of non-toxic anti-fouling products by vessel owner/operators and educate them about the dangers associated with other products. With non-toxic products, a vessel owner/operator would have to clean the hull more frequently than if they were to use copper-based anti-fouling products. However, non-toxic products do not need to be reapplied as often as copper-based products.

The recommended goods movement measures are to improve efficiencies in port activities to reduce GHG emissions. Many of these efficiencies could result in reduced fossil-fuel combustion. Reduced fossil-fuel combustion at ports has similar potential benefits described in the evaluation of measures T-1 and T-3. Improvements in ocean and harbor vessels could also potentially reduce regular and accidental discharges to water.

(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency 0.93 MMTCO_2E

(T-8) Medium and Heavy-Duty Vehicle Hybridization 0.5 MMTCO_2E

Measures T-7 and T-8 are not expected to affect native species or biological resources, as they are not expected to change the number of vehicles in 2020. Measure T-7 is estimated to avoid some fossil-fuel combustion, and in that respect could have benefits similar to measures T-1 and T-3.

(T-3) Regional Transportation-Related Greenhouse Gas Targets 5 MMTCO_2E

Under this measure ARB would work with MPOs to establish passenger vehicle greenhouse gas emission reduction targets (regional targets) for 2020 and 2035. The specific land resource impacts of particular land use and transportation strategies applied to implement this measure would be evaluated under existing applicable regulatory structures as they are triggered, including CEQA. Generally, this measure encourages more low impact, compact growth in urban areas that can also emphasize biological-species friendly development, incorporation of wildlife corridors, conservation of open spaces and valuable habitat, and reduced overall footprint. These types of activities would benefit biological resources and native species directly. Indirectly, reducing impacts on water quality and air quality could also benefit biological resources and native species.

(T-9) High Speed Rail 1 MMTCO_2E

The Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its analysis of biological resources. The programmatic EIR/EIS examined the impacts of the High Speed Rail on biological resources at a statewide level, finding that the HSR has the potential for significant impacts on biological resources and wetlands. This is largely due to the need for new infrastructure corridors in areas of biological resources. The PEIR/EIS identifies program design, mitigation, and further evaluation strategies to minimize these impacts.

3. ELECTRICITY AND NATURAL GAS

Regulatory Background

For large energy facilities, the **CEC Certification process** serves as an equivalent to the otherwise required state and local permitting requirements. The CEC has authority to certify (permit) the construction and operation of thermal electric power plants 50 megawatts or larger

and all related facilities. The site certification process provides a review and analysis of all aspects of a proposed project, including water supply availability and wastewater impacts, equivalent to the CEQA process. This is also a public process. Smaller facilities with no potentially significant environmental impacts can apply for an exemption process, similar to a mitigated negative declaration approach under CEQA.

The CEC works with local governments to ensure a functionally equivalent permitting process. CEC prepare the necessary evaluation in a "Preliminary Staff Assessment", working with federal, state, and local government to ensure it provides the information needed for the respective agencies to approve the project and either serves as the appropriate permit or basis for the appropriate permit.

SWRCB's "**Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling**" (Order No. 75-58) encourages the use of alternative sources of cooling water and/or the use of alternative cooling technology. Alternative sources of cooling water identified in the policy include wastewater, irrigation return flows, and naturally brackish water. The policy also encourages the evaluation of dry or wet/dry cooling technology for those facilities that may require water from the Sacramento-San Joaquin River Delta. A fundamental purpose of this regulation is to protect species from impingement and entrainment by cooling tower intakes and from thermal discharges of cooling towers.

(E-1) Energy Efficiency (Electricity) 15.2 MMTCO_2E
(CR-1) Energy Efficiency (Natural Gas) 4.3 MMTCO_2E

These measures are not expected to directly affect native species or biological resources. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

(CR-2) Solar Water Heating 0.1 MMTCO_2E

This measure is not expected to affect native species or biological resources, as they are located in developed areas. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

(E-4) Million Solar Roofs 2.1 MMTCO_2E

This measure is not expected to directly affect native species or biological resources, as they are located in developed areas. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

(E-2) Increase Combined Heat and Power 6.7 MMTCO_2E

This recommended measure would not directly impact native species or biological resources, as CHP systems would be installed in existing facilities. Avoided demand for electricity could potentially result in a reduction of the number of power plants constructed in the future, some of which may be developed in areas with important habitat.

(E-3) Renewables Portfolio Standard 21.3 MMTCO$_2$E

This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. This requirement could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons the benefits and impacts of each renewable resources are evaluated relative to natural gas, and are not individually quantified for potential air emissions.

Wind, solar, and geothermal facilities are located where they can best harness these resources, often in rural areas. Although biological resources and native species are best addressed on a project-level basis, a higher-level analysis indicates that projects in rural areas and using greater amounts of land have a significantly greater potential for impacts than their urban, small acreage counterpoints.

Wind energy projects have potential direct and indirect impacts to birds and bats, including death. Siting and design of wind turbines and related infrastructure can minimize potential impacts. Advances in turbine and wind farm design have resulted in the use of fewer, more powerful turbines and better protection for birds. Wind project developers can also use guidelines developed by the California Energy Commission and the California Department of Fish and Game to evaluate and minimize these impacts.

A solar thermal plant requires around 50 times more land than combined-cycle natural gas-fueled power plant per MW. Construction activities associated with solar thermal plants disturb the land, and fencing can interfere with wildlife corridors. Specific impacts will depend on the biological characteristics of the land being developed for solar thermal plants, and sensitive populations and habitat should be avoided as a matter of state policy. The 2007 Environmental Performance Report from the California Energy Commission identifies and discusses the potentially significant and cumulative impacts of a large number of solar plants proposed on Bureau of Land Management (public) lands, including impacts on sensitive species in the Mojave Desert. Projects located in areas where the vegetation and habitat have already been disturbed are preferable. There are also potential issues associated with uncompleted projects, where vast amounts of land are disturbed in facility preparation, but plants are not constructed. Nitrogen dioxide deposition from cooling towers can also degrade vegetation, which is generally mitigated through additional provision of habitat compensation.

There are no current large-scale **solar photovoltaic** plants operating in California, although there are several proposed. Photovoltaic plants use more land per MW than solar thermal plants, and about 80 times the acreage of a combined-cycle natural gas plant per MW. The 2007 Environmental Performance Report states that current technological advances may reduce the land footprint by up to 50 percent. Affects on biological resources and native species would be determined by the location of the plant.

Biomass (forest or agricultural residuals), **anaerobic digesters**, and combustion of **landfill** gases are not expected to affect biological resources and native species outside of their physical construction impacts.

Geothermal projects are frequently located in rural areas and undisturbed areas, but have a relatively small footprint. It is possible that new projects would impact biological resources and would be required to reduce or minimize those impacts through habitat compensation. Nitrogen dioxide deposition from cooling towers can also degrade vegetation.

Small hydropower projects could potentially affect biological species and native species, if they are present in the already-disturbed habitat that manmade channels may provide.

New transmission infrastructure can also impact biological resources and native species through habitat disturbance and alteration (during and following construction) and through direct harm of birds and bats from operating power lines. The RETI project is examining these issues and is expected to have recommendations this year.

4. WATER

Regulatory Background

Water infrastructure includes reservoirs, dams, canals, aqueducts, pipelines, pumping stations, and water treatment plants. Before a facility can be constructed or substantially changed, it must obtain permits to emit air pollutants, use water resources, and to develop land. In this process it must also determine whether it has the potential to impact biological resources, and if so, must comply with existing laws protecting these resources.

(W-1) Water Use Efficiency 1.4 MMTCO$_2$E

This measure identifies the potential for statewide water use efficiency improvement through implementation of individual i.e. per capita voluntary water conservation goals. Increasing statewide, total water demand can be met through individual end use efficiency improvements (appliances and fixtures that use less water than existing appliances and fixtures) and through individual water conservation (changes to behavior and practices). Water demand is expected to grow under the BAU scenario, but it is not clear precisely what the net change in water demand will be in 2020. If water conservation reduces surface water diversions, it can have positive impacts on biological resources by increasing water available for in-stream flows and by reducing aquatic species' mortality at water diversions. If water conservation allows for increased growth, it can impact biological resources where the growth occurs.

(W-2) Water Recycling 0.3 MMTCO$_2$E

This measure proposes to increase water supply reliability to meet increasing demand by increasing water recycling in locations where the energy associated with recycling is less than the energy associated with transporting and treating water. Recycled water is used primarily for landscaping and industrial processes, and is water that would otherwise need to be disposed of, most frequently to a surface water or ocean water. Redirecting this discharge can have positive impacts on receiving water quality, and on the aquatic species in the receiving waters.

(W-3) Water System Energy Efficiency 2.0 MMTCO$_2$E

This measure proposes to reduce the amount of energy used to transport, treat and deliver water. Reductions in air emissions are directly relative to reductions in energy use. ARB expects that this measure will have little to no impact on biological resources. Any projects that have the potential to impact biological resources would be subject to CEQA and other permitting requirements.

(W-4) Reuse Urban Runoff 0.2 $MMTCO_2E$

This measure proposes to increase local surface and groundwater supplies by adopting stormwater management strategies, such as Low Impact Development (LID). LID increases infiltration in urban areas increasing regional stormwater capture and storage. Constructing neighborhood facilities to capture and reuse dry weather flows also increases local supply. These water supplies (270,000 - 333,000 acre-feet) can be used to avoid the need for new imported water supplies with higher energy-intensity. These types of actions have the potential to either impact or benefit biological resources. Increasing infiltration and capturing dry weather flows can benefit biological resources if they reduce surface water diversions and free up water for in-stream flows. They can also interrupt the recharge of surface waters and negatively affect habitat values and they can have localized impacts on biological species through their construction and operation. The design and location of such projects will determine their potential effects on biological resources (direct and indirect), and they should be examined and minimized or mitigated on a project by project basis.

(W-5) Increase Renewable Energy Production 0.9 $MMTCO_2E$

This measure proposes to develop renewable energy projects on lands associated with California's state and local water infrastructure. The potential biological resource impacts associated with these types of projects are evaluated in measure E-3.

(W-6) Public Goods Charge for Water TBD $MMTCO_2E$

This measure proposes to impose a monetary charge on water use and use resulting funds to reduce the GHG emissions from water-related energy use, as described in measures W-1 through W-5. Measures W-1 through W-5 are evaluated separately.

5. INDUSTRY

Regulatory Background

Before a facility can be constructed, it must obtain various permits to emit air pollutants, use water resources, and to develop land. If the proposed facility construction occurs in a location with identified habitat or species, or occurs in the vicinity of a surface water or protected area, the stationary source must comply with:

> **CEQA** requires proposed electricity and natural gas facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public.

(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources TBD $MMTCO_2E$

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

(I-2) Oil and Gas Extraction GHG Emission Reduction 0.2 $MMTCO_2E$
(I-3) GHG Leak Reduction from Oil and Gas Transmission 0.9 $MMTCO_2E$

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

(I-4) Refinery Flare Recovery Process Improvements 0.33 $MMTCO_2E$
(I-5) Removal of Methane Exemption from Existing Refinery Regulations 0.01 $MMTCO_2E$

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

6. RECYCLING AND WASTE MANAGEMENT

Regulatory Background

Before a facility can be constructed, it must obtain various permits to emit air pollutants, use water resources, and to develop land. If the proposed facility construction occurs in a location with identified habitat or species, or occurs in the vicinity of a surface water or protected area, the stationary source must comply with:

> **CEQA** requires proposed electricity and natural gas facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public.

(RW-1) Landfill Methane Control Measure 1.0 $MMTCO_2E$
(RW-2) Additional Reductions in Landfill Methane: Increase the Efficiency of Landfill Methane Capture TBD $MMTCO_2E$

These measures are not expected to directly affect native species or biological resources, as they do not affect land or water resources critical to native species or biological resources.

(RW-3) High Recycling/Zero Waste 9 $MMTCO_2E$

Commercial Recycling proposes to institute mandatory commercial recycling goals. Benefits to biological resources are related to avoiding new landfills and to avoiding production of raw materials.

Increasing Production and Markets for Compost recommends halving the amount of organic material diverted to landfills by creating compost instead. This would require development of new facilities or expansion of existing facilities that produce compost. Siting can be difficult for these facilities because of the nature of their operations and their associated dust and odors. Some facilities are sited at a landfill site, which minimizes their potential individual impact. Biological resource impacts would be similar to siting of other facilities, and would be most relevant on a project-level basis.

Anaerobic digesters are not expected to affect biological resources and native species outside of their physical construction impacts, and their reduction of physical and water wastes.

Extended Producer Responsibility proposes to incorporate the costs of treatment and disposal into the total cost of a product. This should result in environmentally preferable products, as manufacturers seek to reduce overall product costs by minimizing treatment and disposal costs. **Environmentally Preferable Purchasing** would encourage the purchase of environmentally preferable products, products which use less energy, water, virgin materials and hazardous chemicals to produce. These measures intent is to reduce environmental impacts of product manufacturing. Because of the broad spectrum of products, and the geographical extent of extraction and manufacturing, it is not possible to specifically describe potential benefits to

biological resources in California, although some of these benefits would be the reduced demand for landfills and reduced demand for virgin materials.

7. FORESTS

(F-1) Sustainable Forest Target 5 $MMTCO_2E$

This measure recommends establishing and implementing a target to sustain current levels of net carbon sequestration in the Forest sector with actions such as reforesting areas lost to wildfires and improving forest management to reduce the risk of catastrophic wildfires in the state. Deforestation from wildfires or overharvesting can have negative impacts on forest habitat and associated water habitat, particularly by introducing silt and organic carbon into surface waters and by reducing riparian shading. Silt and organic carbon can change water chemistry and can either directly or indirectly affect dissolved oxygen levels, temperatures, and spawning areas crucial to biological resources. Afforestation and reforestation has a potentially significant benefit for biological resources in the state.

8. HIGH GWP

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing 0.26 $MMTCO_2E$

The primary purpose of this Discrete Early Action is to reduce the emissions of the high GWP gas HFC-134a from activities associated with DIY charging. It is not expected to affect biological resources as leaks do not affect biological resources and their reduction will not affect the amount or operation of vehicles or professional service shops.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications 0.3 $MMTCO_2E$

This Discrete Early Action measure will consider a potential ban on the use of SF_6 where technologically feasible and cost-effective alternatives are available, as well as a performance standard for other uses. The use of SF_6 or its replacement gases are not expected to affect biological resources, either directly or indirectly through land, air, or water resources.

(H-3) High GWP Reduction in Semiconductor Manufacturing 0.15 $MMTCO_2E$

This measure recommends requiring manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce high GWP emissions from semiconductor manufacturing. These changes would occur within existing fabricator processes and would not affect biological resources.

(H-4) Limit High GWP Use in Consumer Products 0.25 $MMTCO_2E$

The objective of this measure is to reduce the use of compounds in consumer products with high GWP when alternatives are available. These changes would occur on existing manufacturing sites and would not affect biological resources.

(H-5) High GWP Reductions from Mobile Sources 3.3 $MMTCO_2E$

Each of these measures recommends ways to reduce leaks from refrigerant uses in mobile applications. These changes would not affect biological resources because liquid refrigerants evaporate quickly at room temperature and they are not toxic when airborne.

(H-6) High GWP Reductions from Stationary Sources 10.9 $MMTCO_2E$

Each of these measures recommends ways to reduce leaks from refrigerant uses in stationary applications. These changes would not affect biological resources because liquid refrigerants evaporate quickly at room temperature and they are not toxic when airborne.

(H-7) Mitigation Fee on High GWP Gases 5 $MMTCO_2E$

This measure recommends attaching a fee to the use of high GWP gases. This measure would support the goals and therefore have similar effects as Measures H-1 through H-6.

9. AGRICULTURE

(A-1) Methane Capture at Large Dairies 1.0 $MMTCO_2E$

Methane from dairy manure can be captured through the installation and use of anaerobic digesters. This measure recommends installing anaerobic digesters on new and existing dairies, 89 percent of which are located in the Central Valley. Anaerobic digesters are compatible with agricultural land uses and would be constructed in areas already in use for agriculture. There are no anticipated affects on biological resources from construction of digesters on existing dairies. New dairies would go through environmental review for impacts on biological resources. Pipelines to transmit natural gas to power plants could temporarily impact biological resources during construction, but would also have to undergo a project-specific evaluation and permitting process.

10. SUMMARY

For the most part, recommended measures in the Scoping Plan will occur on already impacted or developed lands, minimizing any potential impacts to native species in biological resources. Measures that result in new facilities to generate power or produce alternate fuels will have the potential to impact native species and biological resources if they are sited in sensitive areas. Special consideration should be given to minimize the impact of new facilities on biological resources, through thoughtful site selection and compliance with existing regulations. Improvements to air quality, water quality, and waste disposal should also benefit native species and biological resources, depending on where they occur.

E. WASTE DISPOSAL AND HAZARDOUS WASTE

Regulatory Background

Solid waste and hazardous materials are regulated at a federal level by U.S. EPA.

> Solid and hazardous waste management is regulated through the **Resource Conservation and Recovery Act** (Title 40 of the Code of Federal Regulations parts 239 through 299)**.** RCRA established a solid waste program (subtitle D) which set guidelines for solid waste management and disposal facilities and prohibits open dumping; a hazardous waste program (subtitle C) which established a "cradle to grave" approach of hazardous material handling; and an underground storage tank program (subtitle I) which regulates tanks storing hazardous substances and petroleum products.

States have developed permitting programs to implement RCRA. In California, there are a number of statutes:

> **Title 14 of the California Code of Regulations (CCR)** enacted the State's solid waste management program. **Title 27 CCR** imposes restrictions on land disposal to protect water resources. CIWMB is the state agency charged with overseeing enforcement of these regulations. Local agencies are responsible for developing, implementing, and enforcement waste management programs that are certified and enforced by the CIWMB.
>
> The Department of Toxic Substances Control (DTSC) implements and enforces California's hazardous materials management program **(Title 22 Division 4.5 CCR)**, in conjunction with Certified Unified Program Agencies (CUPA). Hazardous materials are codified as materials that are toxic, reactive, ignitable or corrosive and have special disposal requirements. Hazardous materials are tracked from generator to waste facility, and handlers have to meet tracking and handling requirements.

Much of the environmental protections around solid waste management are implemented at a local government level. State waste management programs are primarily carried out through **local solid waste enforcement agencies (LEAs)**. LEAs have the primary responsibility for ensuring the correct operation and closure of solid waste facilities in the state. They also have responsibilities for guaranteeing the proper storage and transportation of solid wastes.

> **Integrated Waste Management Plans (IWMPs)** are prepared and implemented by local governments and include waste characterization, source reduction, recycling, composting, solid waste facility capacity, education and public information, funding, special waste (asbestos, sewage sludge, etc.), and household hazardous waste, as well as descriptions of how the IWMP complies with state waste management goals. IWMPs also identify facility locations and are required to work with local governments to ensure that facilities are consistent with land use designations. IWMPs must be locally approved, submitted to, and periodically reviewed for compliance by the CIWMB.

Process of Evaluation

Where possible, existing studies, environmental documentation, and regulatory documentation for measures were reviewed for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was available, ARB consulted experts at state agencies, including at ARB and Climate Action Team agencies. More detailed information about the proposed regulations and the measures under evaluation is provided in Appendix C of the Scoping Plan, as well as in the discussion of the potential impact on air resources.

1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE

The recommended measure is not anticipated to result in a substantial increase in the generation of solid or hazardous wastes. There may be a potential for GHG emission reduction technologies to result in the use of hazardous materials (e.g., ammonia from electricity generation). The cap and trade program will comply with the environmental considerations required by AB 32 as well as existing state and federal regulations. As part of the regulatory development of this measure, this potential will be further examined.

2. TRANSPORTATION

(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards 31.7 MMTCO$_2$E
Feebates – In-lieu of Pavley Regulations 31.7 MMTCO$_2$E
(T-4) Vehicle Efficiency Measures 4.5 MMTCO$_2$E

These measures are not expected to affect waste disposal or hazardous materials, as they do not propose to significantly materially change vehicles. Reduced upstream transport of fuels would reduce the potential for accidental spills.

(T-2) Low Carbon Fuel Standard 15 MMTCO$_2$E

Biodiesel: Biodiesel production uses sodium hydroxide, hexane, sulfuric acid, and methanol. These will be present in any waste generated. Stearates are also likely generated during the esterification process. Glycerol is a by-product that contains unused catalyst, salt, water, methanol, and soaps, and may require special disposal handling.

Ethanol: Current state-of-the-art dry milling plants are expected to generate minimal waste, but any waste materials such as hydraulic oil that is generated would require appropriate disposal if it cannot be reused or reprocessed.

Hydrogen: Precious metals, such as platinum, are expected to be recovered from fuel cells at the end of their useful life. Carbon fiber used in hydrogen tanks is highly valuable as a recycled material.

(T-5) Ship Electrification at Ports 0.2 MMTCO$_2$E
(T-6) Goods Movement Efficiency Measures 3.5 MMTCO$_2$E

These measures are not expected to affect waste disposal or hazardous materials, as they do not propose to significantly materially change vehicles, vessels, structures, or equipment. Reduced upstream transport of fuels would reduce the potential for accidental spills.

One maintenance practice to be considered in the commercial harbor craft measure is the use of anti-fouling products on the hulls to improve hull smoothness. The active ingredient of a number

of anti-fouling products is copper. Excess product, spray mixture, and rinsate associated with the application of copper-containing anti-fouling products must be treated, and disposed of, as hazardous waste if it cannot be used or chemically reprocessed. The encouragement of non-toxic anti-fouling product use and education of owners/operators on the toxicity of copper should reduce the use of and improper disposal of these chemicals

(T-7) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency 0.93 $MMTCO_2E$

(T-8) Medium and Heavy-Duty Vehicle Hybridization 0.5 $MMTCO_2E$

These measures are not expected to affect waste disposal or hazardous materials, as they do not recommend significantly or materially changing vehicles. Reduced upstream transport of fuels would reduce the potential for accidental spills.

(T-3) Regional Transportation-Related Greenhouse Gas Targets 5 $MMTCO_2E$

Under this measure ARB would work with MPOs to establish passenger vehicle greenhouse gas emission reduction targets (regional targets) for 2020 and 2035. The specific land resource impacts of particular land use and transportation strategies applied to implement this measure would be evaluated under existing applicable regulatory structures as they are triggered, including CEQA. Generally, this measure encourages low impact, compact growth in urban areas that have the potential to result in reduced waste disposal due to changes in building and infrastructure construction and operation.

(T-9) High Speed Rail 1 $MMTCO_2E$

The Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its analysis of biological resources. The programmatic EIR/EIS examined the impacts of the High Speed Rail on waste and hazardous resources at a statewide level, finding no specific statewide impacts on waste and hazardous materials, but identifying the need to further evaluate this issue through the subsequent project-level EIR/EIS.

3. ELECTRICITY AND NATURAL GAS

(E-1) Energy Efficiency (Electricity) 15.2 $MMTCO_2E$

(CR-1) Energy Efficiency (Natural Gas) 4.3 $MMTCO_2E$

Appliance and building efficiency standards are designed to reduce energy and water consumption. Overall, the appliance and building turnover rate would not change with this recommended measure, so the production of waste would not be accelerated. Efficiency standards occasionally result in the use of new or new versions of products that contain hazardous materials and require special recycling. One example of this is the fluorescent lamp, which uses a small amount of mercury vapor. To minimize impacts on the environment and landfills, new technologies are being researched and consumers are being encouraged to recycle the lamps.

(CR-2) Solar Water Heating 0.1 $MMTCO_2E$

(E-4) Million Solar Roofs 2.1 $MMTCO_2E$

In operation, solar water heaters do not produce any waste materials. However, some solar cell manufacturing requires trace amounts of potentially toxic chemicals, and many solar cells are being manufactured in California. The Public Interest Energy Research Program of the California Energy Commission investigated this issue and concluded:

"The greatest environmental risk with silicon cells is associated with the use of gases (arsine and phosphine) during the manufacturing process. Thin-film technologies, such as cadmium telluride cells and copper indium diselenide cells, are being developed to increase conversion efficiency and decrease production costs. The most likely routes for environmental release of trace elements are from accidental spills during the manufacturing process. At sites with installed PV modules, release of trace elements from sealed modules is unlikely except due to explosion or fire. Leaching of trace metals from modules is not likely to present a significant risk due to the sealed nature of the installed cells and the plan for recycling of spent modules in the future."[81]

(E-2) Increase Combined Heat and Power 6.7 MMTCO$_2$E

Waste or hazardous materials associated with combined heat and power systems are a function of the fuel used for the system. Natural gas would not produce physical waste. Potential waste impacts of biomass, solar, wind, and fuel cells are discussed in the Electricity and Natural Gas section.

(E-3) Renewables Portfolio Standard 21.3 MMTCO$_2$E

Wind projects do not generate waste during operation, or require hazardous materials for construction.

Solar thermal plants do not produce any waste materials or require toxic or hazardous materials to manufacture. **Photovoltaic** operation and manufacturing is discussed under measures CR-2 and E-4.

Biomass energy is a promising use of waste to create energy and reduce the lands needed for landfill, or the air pollutants associated with open-air combustion. Waste materials used for biomass include corn stover, rice hulls, wheat straw, orchard prunings, forest residuals wooden construction debris, and yard and tree trimmings. The combustion by-product (ash) can be mixed with soils for use as landfill cover, or in pavement aggregate. The refinement of methane gas requires the removal of hydrogen sulfide gas, which produces a liquid waste that is classified as hazardous due to its acidity. This waste will have to be treated to decrease its acidity prior to disposal.

Anaerobic digestion is a form of biological waste processing that destroys harmful biological microorganisms, reduces odors, and physically reduces overall waste mass. This anaerobic process produces methane that would otherwise need to be vented or combusted.

Landfill gas is a byproduct of our current waste management practices, which can be harvested either as natural gas or through combustion.

Municipal solid waste may contain hazardous materials, which could result in solid and gaseous hazardous by-products. Air emissions and ash can be treated to reduce this hazard, ash can be shipped to special landfills, or hazardous materials can be diverted from the waste prior to combustion.

[81] *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells,* EPRI, Palo Alto, CA, and California Energy Commission, Sacramento, CA:2003, 1000095.

Geothermal projects do not produce waste or hazardous materials, other than those described in the air and water resources sections.

Small hydropower projects do not generally have any waste or hazardous materials impacts.

4. WATER

(W-1) Water Use Efficiency 1.4 MMTCO$_2$E

This measure is not expected to affect waste disposal or hazardous materials, as it would not materially change the overall amount of appliances or equipment.

(W-2) Water Recycling 0.3 MMTCO$_2$E

Increased water recycling is not expected to substantially change the amount of biosolids produced and requiring disposal.

(W-3) Water System Energy Efficiency 2.0 MMTCO$_2$E

This measure is not expected to affect waste disposal or hazardous materials, as it would not materially change the overall amount of appliances or equipment. Should this measure result in new water infrastructure, it could have temporary construction-related waste disposal or hazardous materials issues, dependent on the location of construction.

(W-4) Reuse Urban Runoff 0.2 MMTCO$_2$E

This measure could introduce a minor increase in disposal needs, as sediments and pollutants collect in storm water collection basins and need to be removed and disposed as part of the operation and maintenance of these types of facilities. Disposal needs and volume would be a function of location and design of facility, and quality of storm water.

(W-5) Increase Renewable Energy Production 0.9 MMTCO$_2$E

This measure proposes to develop renewable energy projects on lands associated with California's state and local water infrastructure. The potential waste impacts associated with these types of projects are evaluated in measure E-3.

(W-6) Public Goods Charge for Water TBD MMTCO$_2$E

This measure proposes to impose a monetary charge on water use and use resulting funds to reduce the GHG emissions from water-related energy use, as described in measures W-1 through W-5. Measures W-1 through W-5 are evaluated separately.

5. INDUSTRY

(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources TBD MMTCO$_2$E

The potential energy efficiency improvements that may result from this measure are not expected to impact waste disposal.

(I-2) Oil and Gas Extraction GHG Emission Reduction 0.2 MMTCO$_2$E
(I-3) GHG Leak Reduction from Oil and Gas Transmission 0.9 MMTCO$_2$E

These measures are not expected to affect waste disposal or hazardous materials.

(I-4) Refinery Flare Recovery Process Improvements 0.33 MMTCO$_2$E
(I-5) Removal of Methane Exemption from Existing Refinery Regulations 0.01 MMTCO$_2$E

These measures are not expected to affect waste disposal or hazardous materials.

6. RECYCLING AND WASTE MANAGEMENT

(RW-1) Landfill Methane Control Measure 1.0 MMTCO$_2$E
(RW-2) Increase the Efficiency of Landfill Methane Capture TBD MMTCO$_2$E

These measures recommend reducing the impacts of current landfill practices on GHG emissions and toxic air contaminants, so they reduce the environmental impact of the State's current waste management practices.

(RW-3) High Recycling/Zero Waste 9 MMTCO$_2$E

Commercial Recycling recommends instituting mandatory commercial recycling goals. This would reduce the demand for landfill space in California and replace materials produced from virgin materials. There are no hazardous materials associated with commercial recycling.

Increasing Production and Markets for Compost recommends halving the amount of organic material diverted to landfills by creating compost instead. This would reduce the demand for landfill space in California and replace composts from virgin materials. There are no hazardous materials associated with green waste composting.

Anaerobic digestion is a form of biological waste processing that destroys harmful biological microorganisms, reduces odors, and physically reduces overall waste mass.

Extended Producer Responsibility recommends incorporating the costs of treatment and disposal into the total cost of a product. This should result in environmentally preferable products, as manufacturers seek to reduce overall product costs by minimizing treatment and disposal costs. **Environmentally Preferable Purchasing** would encourage the purchase of environmentally preferable products, products which use less energy, water, virgin materials and hazardous chemicals to produce. These measures intent is to reduce environmental impacts of product manufacturing. Because of the broad spectrum of products, and the geographical extent of extraction and manufacturing, it is not possible to specifically describe potential benefits to biological resources in California, although some of these benefits would be the reduced demand for landfills.

7. FORESTS

(F-1) Sustainable Forest Target 5 MMTCO$_2$E

This measure recommends establishing and implementing a target to sustain current levels of net carbon sequestration in the Forest sector with actions such as reforesting areas lost to wildfires and improving forest management to reduce the risk of catastrophic wildfires in the state. Harvested materials would either go to manufacturing as virgin materials, to biomass facilities (evaluated under measure E-3), or to landfills. One of the objectives of this target is to maximize the diversion of forest waste from landfills to biomass facilities. As the details for this measure are developed, ways to minimize potential impacts on landfills will be evaluated.

8. HIGH GWP

(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing 0.26 $MMTCO_2E$

The primary purpose of this Discrete Early Action is to reduce the emissions of the high GWP gas HFC-134a from activities associated with DIY charging. HFC-134a is not a hazardous material. DIY charging is done through the use of disposable cans. This measure is not expected to affect waste disposal or hazardous materials except to the degree that disposable cans are not produced and replaced with the use of reusable canisters by professional servicers.

(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications 0.3 $MMTCO_2E$

This Discrete Early Action measure will consider a potential ban on the use of SF_6 where technologically feasible and cost-effective alternatives are available, as well as a performance standard for other uses. The use of replacement for SF_6 are not expected to affect waste disposal or increase hazardous materials, as this measure would not increase the volume of gases used and the currently identified replacement gases are non-toxic.

(H-3) High GWP Reduction in Semiconductor Manufacturing 0.15 $MMTCO_2E$

This measure recommends requiring manufacturers to use process optimization, alternative chemistries, and abatement technologies in combination or separately to reduce high GWP emissions from semiconductor manufacturing. These changes would occur within existing fabricator processes and would not affect waste disposal or hazardous materials.

(H-4) Limit High GWP Use in Consumer Products 0.25 $MMTCO_2E$

The objective of this measure is to reduce the use of compounds in consumer products with high GWP when alternatives are available. These changes would occur on existing manufacturing sites and would not affect waste disposal or hazardous materials.

(H-5) High GWP Reductions from Mobile Sources 3.3 $MMTCO_2E$

High GWP gases and their proposed replacement gases are not classified as hazardous materials; therefore, none of these measures would affect hazardous materials.

The **Air Conditioner Refrigerant Leak Test during Vehicle Smog Check** measure recommends reducing the number of in-use MVACs that leak excessively by identifying them through the existing Smog Check program and requiring their subsequent repair. This additional test procedure and repair requirement would occur on existing commercial sites and would not require replacing any equipment, therefore it would not affect waste disposal.

The **Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers** measure recommends recovering refrigerant remaining in the decommissioned containers' cooling systems, reducing leakage from these containers, and ensuring proper disposal as they approach their end-of-life. This measure is not expected to significantly change the current disposal methods of refrigerated shipping containers, but could possibly allow a greater reuse of containers; therefore, this measure is not anticipated to affect waste disposal.

The **Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems** measure recommends improving compliance with existing regulations prohibiting the venting of certain types of refrigerant, including HFCs, to the

atmosphere when MVAC equipment is serviced or dismantled. Venting is avoided by recovering refrigerants with specialized equipment before dismantling or servicing. Improved compliance with existing regulations would not affect waste disposal.

(H-6) High GWP Reductions from Stationary Sources 10.9 MMTCO$_2$E

High GWP gases and their proposed replacement gases are not classified as hazardous materials; therefore, none of these measures would affect hazardous materials.

Two measures are proposed as the **High GWP Stationary Equipment Refrigerant Management Program.** The **Refrigerant Tracking/Reporting/Repair/Deposit Program** measure recommends requiring commercial and public facilities with large stationary air conditioning and refrigeration equipment to minimize emissions of high GWP refrigerants through reporting, leak repair, improved servicing, and end-of-life control. The **Specifications for Commercial and Industrial Refrigeration Systems** measure proposes new specifications for commercial and industrial refrigeration systems to both reduce emissions of high GWP refrigerant and to increase energy efficiency of the units. These changes would occur on as existing equipment is replaced and would not affect waste disposal.

Insulation foam that is diverted to landfills emits high GWP gases into the atmosphere. The **Foam Recovery and Destruction Program** measure recommends minimizing these emissions to as close to zero as possible by diverting waste foam away from landfills and destroying the foam at high temperatures, or by capturing the high-GWP GHGs within the foam and destroying the foam gas. This program could reduce the amount of waste foam diverted to landfills.

The **SF_6 Leak Reduction and Recycling in Electrical Applications** measure recommends reducing emissions of SF_6 within the electric utility sector and at particle accelerators by requiring the use of best achievable control technology for the detection and repair of leaks, and the recycling of SF_6. Additionally, particle accelerator industry representatives are considering the use of possible substitute mediums. These changes could replace a small amount of equipment earlier than expected, but otherwise would not affect waste disposal.

The **Alternative Suppressants in Fire Protection Systems** measure recommends evaluating the use of alternative suppressants in total flooding (fixed) and streaming (portable) fire suppression systems. The use of alternative suppressants is expected to have only minor operational impacts at existing commercial and residential sites; therefore, the measure would not affect waste disposal.

The **Residential Refrigeration Early Retirement Program** measure recommends partnering with existing voluntary programs to retire inefficient residential refrigeration appliances such as refrigerators and freezers. Appliance early retirement includes the recovery of high-GWP refrigerants and blowing agents for reclamation or destruction to avoid GHG emissions. This program could accelerate diversion to landfills of older appliances (post-refrigerant recovery), but is not expected to significantly increase the overall diversion to landfills.

(H-7) Mitigation Fee on High GWP Gases 5 $MMTCO_2E$

This measure recommends attaching a fee to the use of high GWP gases. This measure would support the goals and therefore have similar effects as Measures H-1 through H-6.

9. AGRICULTURE

(A-1) Methane Capture at Large Dairies 1.0 $MMTCO_2E$

Methane from dairy manure can be captured through the installation and use of anaerobic digesters. Anaerobic digestion is a form of biological waste processing that destroys harmful biological microorganisms, reduces odors, and physically reduces overall waste mass. The waste materials are generally combined with other dairy solid manure wastes as a soil amendment or fertilizer for dairy feedstocks, and would not increase the amount of dairy manure waste.

The refinement of methane gas requires the removal of hydrogen sulfide gas, which produces a liquid waste that is classified as hazardous due to its acidity. This waste may be able to be used to amend alkaline soils to restore pH, otherwise it would have to be treated to decrease its acidity prior to disposal.

This measure recommends voluntary installation of anaerobic digesters on new and existing dairies, 89 percent of which are located in the Central Valley. Anaerobic digesters are compatible with agricultural land uses and waste processes and would mostly be constructed in areas already in use for agriculture. New dairies would go through environmental review for impacts on biological resources.

10. SUMMARY

Recommended measures in the Scoping Plan will not substantially affect waste disposal or hazardous materials, when compared with the Business As Usual Scenarios. The benefits of the Scoping Plan come through measures that reduce demands for new facilities, water, and products, as well as measures that reduce diversions to landfills and transition to less hazardous products.

4. PUBLIC HEALTH AND SAFETY

Public health and safety in California can be expected to be adversely impacted by climate change. Several recent studies have addressed potential implications for human health at the national and international levels.[82] Greater climate variability and changes in climate patterns would potentially cause both direct and indirect health effects. Direct health and safety impacts would result from extreme events, such as heat waves, droughts, increased fire frequency, and increased storm intensity resulting in flooding and landslides. Secondary or indirect health effects would be associated with damages to infrastructure that cause, for example, sanitation and water treatment problems that increase water-borne infections. Air quality impacts such as increases in tropospheric ozone due to higher temperatures would also have health impacts.

A. AIR QUALITY-RELATED PUBLIC HEALTH

ARB has many program and plans that are designed to identify and mitigate public health problems due to air quality throughout the state. ARB has identified harbor communities and sensitive populations as a priority when addressing toxic and criteria air contaminants. The Proposed Scoping Plan builds on ARB's priorities and on-going efforts to reduce air pollution. Within this environmental evaluation ARB staff has quantified, where possible, the potential changes to NOx, VOC, primary and secondary PM2.5, and air toxics that would result from implementation of the recommended measures in the Scoping Plan.

For this section of the evaluation, staff estimated the health impacts associated with PM2.5 exposure on a state level. This evaluation focuses on PM 2.5 because this pollutant accounts for the majority of premature deaths associated with air pollution in California. Although we have estimated statewide changes to emissions of key criteria pollutants in 2020, we have not specifically assigned emission changes to individual facilities or transportation corridors. Because of this, we cannot reliably model future air quality conditions across the state. Without such modeling, it is difficult to estimate health outcomes of criteria pollutants like ozone, whose chemistry is highly dependent on precursors and weather conditions and whose health outcomes are highly dependent on length and magnitude of exposure.

We have estimated statewide health outcomes for PM2.5 because the sources of PM2.5 are distributed in similar proportions and patterns to populations, and are not strongly dependent on meteorology for their formation or for their direct emission and exposure pathways. Staff based the evaluation on the GMERP public health methodology.[83] There are many assumptions made in this exercise which add to the uncertainty of the estimates, including translating regional emission and health outcome information to statewide information, estimating criteria pollutant reductions for measures, and assuming that emissions and exposures are geographically proportional. This analysis is intended to provide comparative information on the recommended measures.

[82] Patz et al., 2000.
[83] http://www.arb.ca.gov/planning/gmerp/gmerp.htm.

Regulatory Background

ARB's first priority continues to be the protection of public health, and now it joins with other agencies, states, and countries to protect public health on a global level, through the reduction of greenhouse gases. All of the recommended measures and measures under evaluation in this Scoping Plan are designed to reduce greenhouse gases, and many of these measures would also contribute to ARB's goals of reducing criteria pollutants and toxic air contaminants. Some of the recommended measures may result in minor increases to co-pollutants, but these minor increases must be evaluated in the overall context of both the AB32 program and existing ARB programs, which are briefly described below:

Federal clean air laws require areas out of attainment with national ambient air quality standards to prepare **State Implementation Plans (SIP)** identifying actions to bring areas into compliance in a set timeframe. Under State law, ARB has the responsibility to develop SIP strategies for mobile sources and consumer products, to coordinate SIP strategies with the Bureau of Automotive Repair and the Department of Pesticide Regulation, and to oversee local district programs for stationary sources. In 2007, ARB adopted the State Strategy for Implementation of Ozone and PM2.5 Standards.

The Air Toxics "**Hot Spots**" Information and Assessment Act (AB 2588, 1987, Connelly) requires stationary sources to report the types and quantities of certain substances routinely released into the air. The goals of the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, to notify nearby residents of significant risks, and to reduce those significant risks. The public has access to facility emissions and risk data for specific facilities. The "Hot Spots" Act also requires local air districts to prioritize which facilities must perform a health risk assessment based on the potency, toxicity, and quantity of emissions released from the facility to determine if the facility poses a significant risk. High-risk facilities must reduce their toxic emissions and risk to acceptable levels that are determined by the local air districts. District annual reports summarize the results and progress of health risk assessments, and rank and identify facilities that pose a risk to public health.[84]

An important source of directly emitted PM2.5 is diesel exhaust. The particulate matter from diesel-fueled engines (diesel PM) was identified as a toxic air contaminant by ARB in 1998. Nearly 70 percent of the known cancer risk caused by air toxics in California is attributed to diesel PM. In 2000, ARB adopted a **Diesel Risk Reduction Plan** to reduce diesel PM emissions by 85 percent by 2020. ARB has since adopted a number of regulatory measures to reduce diesel PM emissions statewide including requirements for in-use trash trucks, public agency-owned trucks, buses, stationary engines, transportation refrigeration units, cargo handling equipment, and off-road equipment. ARB will soon consider adoption of a regulation to reduce emissions from in-use heavy-duty trucks. Diesel control measures reduce both direct diesel PM and NOx emissions through a combination of engine retrofits and replacements. Upcoming mobile source fleet measures to reduce diesel PM and NOx emissions are a critical part of the new State Implementation Plan strategy, Diesel Risk Reduction Plan, and the Scoping Plan.

[84] http://www.arb.ca.gov/ab2588/reports.htm

The **Emission Reduction Plan for Ports and Goods Movement in California (GMERP)**, approved by ARB in April 2006 identified key new measures necessary to meet federal air quality standards and reduce health risk in communities near ports and railyards. Ships are the largest source of SOx emissions in the state. Heavy-duty trucks move most goods within and through the state, and are the largest statewide source of NOx emissions. This makes it essential to address goods movement emissions in order to meet PM2.5 air quality standards. Likewise, emission reduction targets for ozone will not be met without reducing emissions related to goods movement.

The strategies included in the GMERP target ships and trucks, as well as the other three main sources of goods movement emissions: harbor craft, cargo handling equipment, and locomotives. By 2020, these strategies will cut statewide goods movement emissions of NOx by 63 percent, SOx emissions by 78 percent, and will also reduce the statewide health risk from goods movement-related diesel particulate matter by 85 percent.

Many of the strategies in the GMERP are adopted and will provide essential new emission reductions needed for regional attainment, while they reduce the air pollution-related health risk for those who live near our ports, rail yards, distribution centers, and other goods movement facilities. Emission reductions from those GMERP strategies that were not adopted by the end 2006 are identified as new measures in the 2007 SIP as new measures.

In addition, ARB's **Harbor Communities Monitoring Study (HCMS)** is designed to improve tools for measuring pollutant concentrations in the air and detecting areas where concentrations of these pollutants are high. This study consists of three types of air pollution sampling: a network of passive samplers, a mobile platform, and a network of particle counters. The sampling will characterize temporal and spatial variations of air pollution in the study region. The sampling was conducted during 2007. The pollutants being measured include, but are not limited to black carbon, carbon monoxide, nitrogen oxides, particulate matter, ultrafine particles, volatile organic chemicals, and hydrogen sulfide.

The communities being studied include Wilmington and parts of San Pedro, West Long Beach, and Carson. These communities were chosen because of the emission sources in the area and the close proximity of residents to these emission sources. The Harbor Communities are located just north of the Ports of Los Angeles and Long Beach, which handle 40 percent of all container traffic entering the United States; the area is also surrounded by some of the most heavily traveled freeways in Southern California, is home to several large refineries, and a number of rail facilities.

Health Impacts of Ozone (Criteria Pollutant)

The formation and health impacts of ozone are well studied.[85] Ozone is a highly reactive gas that forms in the atmosphere through reactions between chemicals emitted from motor vehicles, industrial plants, consumer products and many other sources. It forms in greater quantities on hot, sunny, calm days making the summer season the key exposure period.

[85] CARB, 2005; Anderson, et al, 2004; Thurston, et al 2001; Stieb, et al, 2003; Bell et al, 2004; Levy et al, 2001; and Gryparis, et al, 2004.

Considerable research over the past 35 years has investigated how people respond to inhaling ozone. These studies have consistently shown that inhalation of ozone can lead to inflammation and irritation of the tissues lining the human airways. This causes inflammation and causes the muscle cells in the airways to constrict, thus reducing the amount of air that can be inhaled. Symptoms and responses to ozone exposure vary widely, even when the amount inhaled and length of exposure is the same. Typical symptoms include cough, chest tightness, and increased asthma symptoms. Ozone in sufficient doses can also increase the permeability ("leakiness") of lung cells, making them more susceptible to damage from environmental toxins and infection.

Studies of large populations have found that ozone exposure is associated with an increase in hospital admissions and emergency room visits, particularly for lung problems such as asthma and chronic obstructive pulmonary disease. Several studies have also associated ozone exposure with increased premature mortality in elderly people with chronic diseases of the lungs and circulatory system.

People who exercise or work outdoors are at greater risk of experiencing adverse health effects from ozone exposure because they inhale more ozone. Current evidence has linked the onset of asthma to exposure to elevated levels of ozone in exercising children. Children and adolescents are at increased risk because they are more likely to spend time outdoors engaged in vigorous activities than adults and because they inhale more ozone per pound of body weight.

In order to protect public health, the federal government previously set the national ozone standard at 0.08 parts per million for 8 hours, not to be exceeded, based on the fourth highest concentration averaged over three years. ARB and local air districts have proposed a State Implementation Plan describing the strategies and measures that California will pursue to reduce ozone.[86] However, in March 2008, due to new studies that show health effects at lower concentrations of ozone, U.S. EPA set a new 8-hour ozone standard at 0.075 parts per million. States have less than one year (from March 27, 2008) to provide air quality information to U.S.EPA, which will be used to designate non-attainment areas by 2010. By 2011, states must submit SIPs demonstrating how they will attain the new, more stringent, standard.

Health Impacts of PM2.5 (Criteria Pollutant)

Particulate matter (PM) air pollution is also well studied. Particulate matter pollution is a complex mixture that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. PM can be directly emitted into the air in forms such as dust and soot. It can also be formed in the atmosphere from the reaction of various gases. Inhalable particulate matter is less than 10 microns in diameter (a micron is one-millionth of a meter) and is called PM10. Even smaller particles, those 2.5 microns or less in diameter, are called "fine particles" or PM2.5. PM2.5 is a component of PM10. Diesel PM is particulate matter emitted from diesel-fueled combustion; diesel PM has been classified as a TAC by ARB.

Extensive research has shown that PM can be inhaled into the deep portions of the lungs. Some inhaled particles are exhaled again, but others deposit in the lungs, which can lead to inflammation in both the lungs and the circulatory system. PM2.5 poses an increased health risk because it can penetrate deeper into the lungs and may also enter the bloodstream.

[86] http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm

Population-based studies in hundreds of cities around the world have demonstrated a strong link between exposure to elevated particulate matter levels and premature death, especially in people with pre-existing heart or lung disease. The two most relevant of these studies were performed in many cities in the United States, and have been ongoing for over 15 years. Both of these studies found a strong relationship between long-term PM exposure and premature death. Scientists have observed higher rates of hospitalization, emergency room visits and doctor's visits for respiratory illnesses or heart disease during times of high PM concentrations. During these periods of high PM levels, scientists also observed the worsening of both asthma symptoms and acute and chronic bronchitis, and reductions in various measures of lung function.

The elderly and people with heart and/or lung diseases are particularly at risk of experiencing adverse effects from PM exposure. Studies have also shown that children may be particularly vulnerable to PM effects. There is evidence from the ongoing Children's Health Study, funded by ARB for over ten years, that in communities with high levels of PM children's lungs develop more slowly and that at maturity they tend to have lower lung capacity than children who grow up in communities with lower levels of PM. Just as with ozone, children and infants may also be more at risk of experiencing adverse effects from PM because they inhale more air per pound of body weight than do adults, they breathe faster, and have smaller body sizes. In addition, there is some evidence that children's developing immune systems may cause them to be more susceptible to the effects of PM than adults.

Health Outcomes

ARB most recently updated its methodology for quantifying the health impacts of fine particulate matter during the development of the Goods Movement Emissions Reduction Plan (GMERP). This methodology has been peer-reviewed during the development of the GMERP. To develop quantitative health outcome estimates in the GMERP, ARB reviewed relevant scientific literature on health impacts associated with air pollution exposure and chose a subset of the studies based on strength of methodology and applicability to California residents or conditions. From these studies, concentration-response functions,[87] a measure of observed relative risk, and the associated error terms (95 percent confidence intervals) were obtained for the following health outcomes:

- **Premature death:** A death that occurs at a younger age than would be expected. Air pollution is not implicated as the *cause* of death, but rather a contributing factor in someone whose health is typically already compromised, thereby accelerating the time of death by 14 years.
- **Hospital admissions for respiratory and cardiovascular causes:** Hospitalization admissions for conditions including pneumonia, chronic obstructive pulmonary disease (COPD), asthma, heart attack, stroke, congestive heart failure and cardiac arrhythmia.
- **Asthma and lower respiratory symptoms:** Symptoms such as cough, phlegm production, chest pain, or wheeze, associated with the lower respiratory tract (windpipe, lungs, and airways leading to/associated with the lungs).
- **Acute bronchitis:** Inflammation of the main airways to the lungs, resulting in symptoms such as hacking cough and phlegm production.

[87] A concentration-response function relates changes in exposures to ambient concentrations of a pollutant to changes in an adverse health effect.

- **Work loss days:** Days of missed work for members of the population age 18 through 65.
- **Minor restricted activity days:** Days when a person is not able to engage in their usual range of activities due to minor health conditions. This does not include work loss or bed confinement.

The methodology that ARB uses for quantifying premature death and other health outcomes from PM exposure is based on a peer-reviewed methodology developed by U.S. EPA[88] for their risk assessments. This methodology is regularly updated by ARB staff as new epidemiological studies and other related studies are published that are relevant to California's health impacts analysis.

Estimation/Quantification Process

For this analysis, ARB used a methodology similar to the GMERP process.[89]

Estimated Health Outcomes

The health outcomes estimated for those measures where NOx and PM2.5 reductions were estimated are presented in Table H-8. These outcomes are the result of the 61 TPD NOx and 15 TPD PM2.5 emission reductions described in Table H-7. By 2020, the economic value of these health outcomes is projected to be on the order of $4.4 billion.

Table H-8: Estimates of Statewide Health Outcomes of Recommended Scoping Plan Measures[a]
(mean number of cases)

Health Endpoint	Health Benefits of 2007 SIP *mean*	Health Benefits of Recommended Scoping Plan Measures (Transportation and Electricity and Natural Gas Sectors) *mean*
Avoided Premature death	12,000	780
Avoided Hospital admissions for respiratory causes	1,300	87
Avoided Hospital admissions for cardiovascular causes	2,600	170
Avoided Asthma and lower respiratory symptoms	190,000	12,000
Avoided Acute bronchitis	15,000	980
Avoided Work loss days	1,200,000	77,000
Avoided Minor restricted activity days	7,000,000	450,000

[a] Uncertainty intervals for each estimated benefit range within 20-70 percent of the mean benefit (presented in this table). For example, the number of premature deaths avoided due to the scoping plan could be between 230 and 1,400.

[88] U.S. Environmental Protection Agency, *Regulatory impact analysis for the final Clean Air Interstate Rule*, Office of Air and Radiation, EPA-452/R-05-002, 2005.
[89] http://www.arb.ca.gov/planning/gmerp/gmerp.htm.

B. OTHER POTENTIAL PUBLIC HEALTH AND SAFETY ISSUES

Electric, Hydrogen, and Hybrid Vehicles: High voltage wiring within electric-drive vehicles must be handled appropriately in the case of an accident. Emergency response personnel are trained to identify high voltage wiring to avoid electric shock in the case of an extraction. Hydrogen appears to be as safe as gasoline as a vehicle fuel. Hydrogen is extremely light and buoyant, so it dissipates into the open air very quickly, making any flammable concentration of hydrogen unlikely.

High Speed Rail: The High Speed Rail PEIR/EIS evaluated the potential for public safety issues related to electromagnetic frequency exposures due to the wireless communication system associated with the project. The evaluation concludes that the potential adverse effects could be avoided or mitigated to a less-than-significant level.

Regional Transportation-Related GHG Targets: Various studies suggest that community design has an impact on public health. A greater mix of land uses in a neighborhood can produce a number of public health benefits. A more diverse neighborhood can reduce trips and therefore facilitate walking, biking, and use of transit. Studies show that more compact development is correlated with increased walking and transit trips. Additionally, public health research has shown that there is a direct connection between compact development and lower boy mass indices, lower levels of obesity and decreased instances of hypertension. Although there are limitations with the studies, the findings suggest that low impact development may improve quality of life in many ways. The following co-benefits represent just a few of the many improvements in quality of life.[90]

Social capital has various components. It is generally described as the sense of belonging and civic participation experienced in a community. It is a series of social networks that provide trust and reciprocity and promote cultural and political life. Studies indicate that social capital may increase as people spend less time alone in their vehicles due to improved transportation planning and conducive land uses.[91] Improved social capital has been linked with improved mental health, prolonged life and better overall health.[92] More pedestrian- and cyclist-friendly development and amenities may also help to increase public safety, furthermore strengthening community ties.

There are also many potential health benefits, such as increased access to health care via public transit for people without access to vehicles, and decreased violence and pedestrian injuries and fatalities due to more pedestrian- and cyclist-friendly development. As open spaces and desirable locations (such as shopping, entertainment, schools, etc) become more plentiful, proximate and accessible to pedestrians and cyclists, residents are likely to increase their levels of physical activity. Moderate physical activity reduces many serious health risks, including coronary heart disease, diabetes mellitus, hypertension, anxiety and depression, and obesity.

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[90] Many of these benefits are taken from the CCAP report "CCAP Transportation Emissions Guidebook" (http://www.ccap.org/safe/guidebook/guide_complete.html) and "Understanding the Relationship between Public Health and the Built Environment" report prepared for the LEED-ND Core Committee.
[91] Sullivan and Kuo 1996, Community & Environment Design, 2006.
[92] Ibid.

Access to green space has also been shown to lessen the impacts of mental fatigue and improve cognitive functioning in children.[93]

Decreased commute times and traffic congestion lessen driver-induced stress and the number of traffic injuries and fatalities. Less vehicle use translates into improved air quality and reductions in adverse health impacts, such as death, cancer and exacerbation of asthma, which are most realized in particularly vulnerable populations, the elderly, the young and the health-impaired.

In order to bring about positive change, as well as avoid situations where attempts to solve one problem exacerbate another, it is essential that all levels of government continue to consider other societal, economic and environmental priorities in their decision-making processes related to land use, transportation, and local government operations. For example, some compact development may increase proximity to large sources of pollution, such as high traffic arterials, distribution centers, and industrial facilities, which increases exposure to vehicle air pollution and other toxics and particulates. Communities should be designed to ensure that sensitive land uses such as residences and schools are an adequate distance from these sources. In addition community design should decrease vehicle use, through increasing transit service and walkability, and include buildings with indoor air quality mitigation to further reduce exposure. Agencies should also consider housing supply and affordability needs so that long term housing affordability is not compromised. To maximize benefits and minimize unintended consequences, agencies will need to continually balance multiple priorities through an integrated planning approach.

Agencies should also consider housing supply and affordability needs so that long term housing affordability is not compromised. To maximize benefits and minimize unintended consequences, agencies will need to continually balance multiple priorities through an integrated planning approach.

Green Buildings and Indoor Environmental Quality: U.S. EPA promotes the building industries changing focus to create greener buildings, which includes using healthier, less polluting and more resource-efficient practices. Buildings can be *designed* to improve indoor air quality, lighting, sound, and odor, and public health through their choice of materials and through ensuring frequent circulation of fresh air.[94] ARB encourages the incorporation of these elements into Green Buildings to leverage their external environmental benefits. ARB and CDPH both have programs studying the sources of poor indoor air quality.

Refrigerants: All refrigerants pose both chronic and acute toxicities to people when they are exposed to high enough concentrations. Acute toxicity relates to the dangers posed by short-term exposure to very high concentrations of refrigerant gases, which can increase adrenalin in the body (sensing danger) and deprive exposed individuals of vital oxygen. Chronic toxicity relates to the dangers from long-term regular worker exposure. Refrigerants are studied to determine their risk levels and exposure limits are set to eliminate chronic risks. Workplace guidelines exist to minimize the possibility of acute exposures. In addition to its risks as a refrigerant, N_2O is managed to avoid potentially hazardous interactions with other chemicals.[95]

[93] NACCHO 2008.
[94] http://www.epa.gov/iaq/greenbuilding/index.html.
[95] http://www.osha.gov/SLTC/healthguidelines/nitrousoxide/recognition.html

Refrigerant use is highly regulated and the measures recommended in this plan are not anticipated to significantly change the amount of or way which refrigerants are used. Though any alternatives will be subject to approval under U.S. EPA's Significant New Alternative Program (SNAP) to ensure their safety, it is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace. Also, certain systems may operate at higher pressures thus requiring additional technician training to properly and safely service the equipment.

Compressed Gas in Consumer Products: Some types of consumer products containing compressed gases (for example, whipped cream or computer dusters) are used inappropriately to deprive the brain of oxygen and experience a "high." This deprivation of oxygen can be fatal and can also result in long-term brain damage. The measure recommended in this plan will not change the amount of consumer products or reduce the risk of oxygen deprivation when inhaled. The recommended mitigation fee could make these products more expensive, because of increased costs for the compressed gases.

Wildfire Prevention: Wildfires pose direct and indirect risks to public health and safety. Directly, wildfires can kill and can destroy property, and can, under the right meteorological conditions, result in dangerous levels of ozone and PM2.5. Wildfires pose occupational hazards and exposures to fire fighters. Indirectly, deforestation can result in higher loads of organic carbon in raw water sources, which can react to form potential carcinogens in the drinking water treatment process.

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Regional Assessment of Air Quality-Related Public Health Benefits of Scoping Plan: South Coast Air Basin

Overview

California has a long history of reducing the traditional "criteria" air pollutants that have direct health impacts, including ozone and airborne particulate matter (PM). Many of the sources addressed in the Scoping Plan also emit pollutants that can lead to the formation of ozone or PM, making it likely that the Scoping Plan will provide additional reductions of these precursor emissions and help California meet its health-based air quality goals.

This section addresses the potential reductions in precursor emissions, and the resulting air quality related health benefits, associated with select Scoping Plan strategies. Air pollution levels are regional in nature, influenced by local emission sources, weather patterns, and topography. Similarly, health impacts estimates reflect local pollution and population patterns. As a result, it is appropriate to analyze the co-benefit on a regional basis. This analysis evaluates the co-benefits in the South Coast Air Basin (South Coast) as an example of potential benefits.

Emissions Benefits

California's State Implementation Plan (SIP) identifies strategies designed to ensure that even the state's smoggiest areas will meet air quality standards established by U.S. EPA. Numerous SIPs have been adopted and implemented for various standards, resulting in significantly cleaner air despite growth in the state's population and economy. SIP revisions adopted in 2007-2008 (the 2007 SIP) identify the additional strategies needed to meet the national 8-hour ozone and fine particulate matter (PM2.5) standards that were adopted in 1997 and 2002, respectively.

Table H-9 presents the estimated Scoping Plan co-benefits that will occur in the South Coast as well as the reductions projected from rules and regulations that are already in place, and the reductions that are projected to occur as a result of the recently adopted 2007 SIP. Additional ozone strategies will be developed to meet the 2023 emission target. The discussion that follows provides an explanation of each of the inventory scenarios, and the methodology used to estimate the Scoping Plan co-benefits used in this analysis.

Table H-9: Decreasing Emissions in the South Coast Air Basin (remaining emissions, tons per day)[96]

	NOx	ROG	SOx	PM2.5
Current Emissions	1100	790	61	75
2020 Emissions Projection (existing programs)	530	540	52	71
2020 Emission Projection with new 2007 SIP Measures	380	470	26	60
2020 Emission Projection with Scoping Plan Reductions ("co-benefits")	360	470	26	58

[96] Table H-12 does not include the criteria pollutant co-benefits of additional GHG reductions that would be achieved from the recommended cap-and-trade regulation because we cannot predict in which sectors they would be achieved. PM2.5 emission estimates include combustion sources and paved road dust.

Current Emissions: These emission estimates reflect the benefits of California's comprehensive state and local air pollution control programs. The benefits substantially increase each year as new, cleaner technologies are put in place. Included are mobile source controls such as emission standards for new cars and trucks, smog check, emission standards for new off-road engines, cleaner gasoline and diesel fuels, regulations to reduce evaporative emissions from consumer products, paints, and refueling, and regulatory programs that reduce emissions from stationary source emissions.

2020 Emissions Projection: The 2020 emissions projection reflects current air pollution control requirements along with projections of population and economic activity levels in 2020.

2007 State Implementation Plan: The South Coast is one of several areas in the state that do not meet the national 8-hour ozone standard, and one of only two California regions with PM2.5 levels above the national annual PM2.5 standard. In September 2007, ARB adopted the State Strategy for California's 2007 State Implementation Plan (2007 State Strategy). The control strategies identified in the 2007 State Strategy, together with emission reduction commitments in the locally adopted Air Quality Management Plan, are projected to result in attainment of the national PM2.5 standard by 2014 and significant progress towards ozone attainment. Additional strategies will be developed to bring the region fully into ozone attainment by 2023. Table H-10 summarizes the projected 2020 NOx and PM2.5 emission benefits associated with control measures in the 2007 SIP for the South Coast Air Basin.

The 2007 State Strategy focuses on reducing emissions from the state's mobile sources such as trucks, construction equipment, and ocean-going ships. The diesel engines in many of these sources are designed to last for decades – as a result, there are opportunities to reduce emissions by upgrading or replacing older vehicles in these fleets. The 2007 SIP uses a combination of regulatory requirements and incentive programs to reduce emissions from business and commercial fleets. NOx emissions are precursors to both ozone and PM2.5. New State and local control strategies in the 2007 SIP for the South Coast Air Basin are projected to reduce NOx emissions by about 29 percent from 2020 projections. The 2007 SIP together with the Scoping Plan co-benefits will reduce 2020 emissions by about 31 percent.

The 2007 SIP also includes local commitments for further development and exploration of 22 measures for which emission reductions cannot be quantified at this time.

Scoping Plan Reductions: Table H-9 also shows pollutant emission reductions anticipated to occur in the South Coast Air Basin as a result of the Scoping Plan. The projected Scoping Plan benefits are at least one order of magnitude smaller than the reductions attributed to the existing program and the 2007 SIP, in large part because of the effectiveness of the ozone and PM2.5 controls that will be in place by 2020. The methodology used to estimate the co-benefits focused on the most significant Scoping Plan measures and is described below.

Table H-10: 2007 SIP New NOx and PM2.5 Measures
Estimated Emission Reductions in 2020
in the South Coast Air Basin
(tons per day)

	NOx	$PM_{2.5}$
MOBILE SOURCES		
Passenger Vehicle Smog Check Improvements	8	0
Expanded Passenger Vehicle Retirement	1	0
Cleaner In-Use Heavy-Duty Trucks	27	2
AB923 Medium-Duty Vehicle High-Emitter Identification Program	1	0
Auxiliary Ship Engine Cold Ironing and Other Clean Technology	28	0
Cleaner Main Ship Engines and Fuel	32	3
Port Truck Modernization	8	0
Accelerated Introduction of Cleaner Line-Haul Locomotives	12	0
Clean Up Existing Harbor Craft	5	0
Cleaner In-Use Off-Road Equipment	19	2
AREAWIDE SOURCES		
Wood-Burning Fireplaces and Wood Stoves	0	1
Under-Fired Charbroilers	0	1
New and Redevelopment Projects	1	0
STATIONARY SOURCES		
NOx Reduction from Non-RECLAIM Ovens, Dryers and Furnaces	4	0
Further NOx Reductions from Space Heaters	2	0
Facility Modernization	2	1
REGIONAL TOTAL	**150**	**10**

Co-Benefits Estimation Methodology

Co-benefits were estimated for the four major sectors addressed in the Scoping Plan, as discussed below. Scoping Plan emission benefits for criteria pollutants were based on the ARB greenhouse gas inventory methodology. This inventory is comparable, but not identical to that used in the SIP.

Electricity Generation: The Scoping Plan reflects the goals of increasing California's Renewables Portfolio Standard (RPS) for the mix of power generation to 33 percent by 2020 (measure E-3), increasing the energy efficiency of new and existing buildings (measure E-1), and California's solar roof initiative (measure E-4). Statewide, these measures are designed to reduce fossil fuel generation by 88.1 terra watt-hours (TW-hrs) per year in 2020 – fossil fuel electrical generation is projected to account for 369 TW-hrs per year without the Scoping Plan strategies. The reduction in fossil fuel-based electrical generation – approximately 24 percent

beyond today's renewable energy level – was applied to forecasted electrical generation emissions in the South Coast Air Basin in 2020 to calculate the potential regional benefits of these measures in 2020.

Residential/Commercial Fuel Combustion: The Scoping Plan considers energy efficiency improvements in the residential and commercial fuel combustion area that would reduce natural gas combustion rates by 826 million therms (MMtherms) in 2020 (measures CR-1 and CR-2). This value was divided by the statewide forecasted natural gas combustion rate in the residential and commercial sectors of 8,171 MMtherms to derive a reduction fraction of 10 percent. This reduction fraction was applied to the combined emissions of residential and commercial fuel combustion in the South Coast Air Basin to calculate the benefits of this measure in 2020.

Gasoline Measures – On-Road Motor Vehicles: The Scoping Plan identifies greenhouse gas benefits from full implementation of AB1493 Pavley Phase I and Phase II for on-road passenger vehicles (measure T-1), from increased vehicle efficiency measures (measure T-4), such as tire pressure regulation, and from reduced growth in vehicle miles-traveled (VMT) (measure T-3). These measures are estimated to provide additional reductions in gasoline combustion beyond what was accounted for in the SIP baseline emission inventory. The statewide estimate of Scoping Plan benefits from these measures was used to estimate benefits for the South Coast Air Basin using the ratio of VMT in the South Coast Air Basin in 2020 to statewide VMT in 2020.

Diesel Measures: Diesel Measures: The Scoping Plan includes measures that would reduce vehicular diesel combustion emissions, including aerodynamic improvements (measure T-7), and medium/heavy-duty hybridization (measure T-8). The South Coast co-benefits for these measures were calculated from the statewide estimate, distributed by regional VMT. The regional co-benefits estimate for goods movement efficiency measures (measure T-6) was determined using the region's portion of statewide emissions from ocean-going vessels and harborcraft.

Industrial Measures: The Scoping Plan also recommends placing industrial sources in an emissions cap, an energy-efficiency audit for large industrial sources including refineries, and measures to reduce fugitive methane emissions from oil and gas transmission and extraction, fugitive emissions and flaring and from refineries. The fugitive emissions in the South Coast region from oil and gas transmission and extraction, and refineries are small. Reduced flaring is expected to result in a small reduction in criteria pollutants due to reduced natural gas combustion.

Health Benefits Analysis

Ambient air quality standards are established to protect people from adverse health effects of associated with air pollution. The health impacts associated with ozone and PM2.5 range from respiratory effects to premature death. This section discusses the projected changes in health impacts that will occur as a result of the co-benefits of the Scoping Plan in the South Coast Air Basin, California's most polluted region.

The methodology that ARB uses to quantify premature death and other health impacts from exposure to air pollutants is based on a peer-reviewed methodology developed by U.S. EPA. ARB augmented EPA's methodology by incorporating the results of new epidemiological studies relevant to California's population, including regionally specific studies, as they became

available. The methodology was described in ARB's March 2006, *Emission Reduction Plan for Ports and Goods Movement (Goods Movement Plan*), and was updated in the recent staff report for estimating premature death from exposure to particulate matter.[97]

Table H-11 shows relative benefits of the existing programs, the 2007 SIP, and the Scoping Plan in the South Coast in 2020. There is uncertainty inherent in the values shown here, which represent the mean of a range of estimated impacts. These estimates do not provide an absolute number of health impacts avoided. Instead, they provide a way to compare the relative contribution of Scoping Plan co-benefits to the improvements in public health expected from ARB's ongoing pollution control program. Health impacts are defined on page H-97.

Table H-11: Estimated Air Quality-Related Health Benefits of Existing Program, 2007 SIP, and Scoping Plan in the South Coast Air Basin, 2020[a]
(mean number of cases)

Health Impacts / Scenario	Benefits from Existing Program	Additional Benefits from 2007 SIP	Additional Co-Benefits from Scoping Plan
Premature Deaths Avoided	4,800	2,000	360
Hospitalizations Avoided – Respiratory	550	230	40
Hospitalizations Avoided – Cardiovascular	1,100	440	77
Asthma & Lower Respiratory Symptoms Avoided	80,000	35,000	6,200
Acute Bronchitis Avoided	6,400	2,800	500
Work Loss Days Avoided	510,000	220,000	38,000
Minor Restricted Activity Days Avoided	3,000,000	1,300,000	220,000

[a]Uncertainty intervals for each estimated benefit range within 20-70 percent of the mean benefit (presented in this table). For example, the number of premature deaths avoided due to the Scoping Plan could be between 110 and 640.

[97] Air Resources Board. *Methodology for Estimating Premature Deaths Associated with Long-term Exposure to Fine Airborne Particulate Matter in California.* October 24, 2008. http://arb.ca.gov/research/health/pm-mort/pm_final.pdf (accessed December 9, 2008)

Community Level Assessment of Air Quality-Related Public Health Benefits of Scoping Plan: Wilmington Example

Summary

For this assessment, ARB evaluated criteria pollutant emission reductions in the Wilmington study area assuming that the source-specific quantified greenhouse gas measures are implemented. It was further assumed that the non-source specific program elements such as the proposed cap-and-trade program result in a 10 percent reduction in fuel combustion by affected sources within the study area. For example, it is estimated that industrial sources would achieve greenhouse gas emission reductions through efficiency measures that reduce on site fuel use by 10 percent either in response to a cap-and-trade program, or due to the results of the facility energy efficiency audits. While it is likely that the actual onsite reductions will differ across individual facilities from the assumed uniform 10 percent reduction,[98] the analysis identifies how reductions at these facilities affect the overall level of co-benefits.

The estimated NOx co-benefit of about 1.7 tons per day is small relative to the projected reductions of 24 tons per day that will occur as a result of the SIP and other measures. For example, an 8 ton per day NOx reduction is expected from cleaner port trucks. In comparison, the potential NOx benefit from a 10 percent efficiency improvement in major goods movement categories is estimated at about 1.5 tons per day. The estimated PM2.5 co-benefits, on the order of 0.12 tons per day, are also small relative to the projected reductions of 2.3 tons per day that will occur as a result of the SIP and other measures. Approximately 30 percent (0.04 tons per day) of the PM 2.5 co-benefit reduction is associated with assumed energy efficiency measures at the four large refineries in the study area, while another 30 percent would occur due to a 10 percent efficiency improvement by goods movement sources.

The co-benefit emission reductions in the study area would produce health benefits for the population in the study area (approximately 300,000 area residents) as well as regional benefits among a much larger population. Health benefits due to reductions in NOx are mostly at the regional levels, since NOx emissions have usually travelled some distance before they are transformed into PM via atmospheric reactions. Point source combustion PM emissions persist in the atmosphere and increase exposures both in the area where they are emitted and broadly throughout the region. Based on previous modeling studies of the impact of port and rail yard PM emissions in the South Coast Air Basin conducted by ARB, PM exposures will be reduced far beyond the study area, and a majority of the health benefits are expected to occur in areas outside of the Wilmington community.[99] Using the previously described methodology that correlates emission reductions in the air basin with expected health benefits there would be approximately 24 avoided premature deaths. There is considerable uncertainty inherent in the health impact estimates, particularly for a very localized area such as this. However, the impact estimates are provided here as a way to compare the relative contribution of Scoping Plan co-benefits to the improvements in public health expected from ARB's ongoing pollution control program.

[98] The reductions at any one facility could be much greater or lesser than 10 percent For example very small or no reductions might occur because available cost-effective industrial emission reductions have already been implemented at a particular site.

[99] ARB staff analysis indicates that no more than one-third of the health benefits would occur in the Wilmington area.

Overview

Air quality throughout California continues to improve, even with population and economic growth, due to extensive statewide programs that address the smog-forming criteria pollutants and toxic air contaminants. Overall emissions are declining in all communities, although the rate may vary depending upon the nature of local sources. Mobile sources are the dominant source of pollution exposure in communities statewide. Criteria pollutant emission reductions of hundreds of tons per day are estimated statewide by the 2020 timeframe from a combination of longstanding requirements and new measures in ARB adopted plans such as:

- Diesel Risk Reduction Plan (adopted September 2000)
- Goods Movement Emission Reduction Plan (adopted April 2006)
- State Implementation Plan (SIP) (adopted September 2007)

In addition, there will be incremental additional criteria pollutants reductions as a co-benefit of new actions under the AB 32 Scoping Plan for greenhouse gases, primarily due to measures that reduce fuel combustion. This analysis provides preliminary estimates of emission changes for the example community of Wilmington, between 2005 and 2020, due to current programs and the potential incremental co-benefits of measures recommended in the Scoping Plan. The magnitude of criteria pollutant co-benefits for a single community will generally be quite small (less than two tons per day of emission reductions in this example), compared to the benefits of all the existing public health programs to reduce air pollution.

Table H-12 summarizes the emission reductions estimated for NOx and PM2.5. Current emissions in the Wilmington community and projected emission levels in 2020 were derived from ARB's ozone modeling inventory. The combined impact of existing programs and new measures in the 2007 SIP is a projected 40-45 percent reduction in 2020 NOx and PM2.5 emissions levels, taking into account projected growth. Scoping Plan measures are estimated to reduce Wilmington area emissions by an additional one to two percent. The methods used to estimate the emissions impact, and the potential public health benefits, are discussed in this document.

Table H-12: Summary of Estimated Emission Reductions – Wilmington Study Area
(tons per day)

	NOx	**PM2.5**
Current Emissions	52.2	5.6
2020 Emission Reductions		
Reductions from existing programs and 2007 SIP	23.7	2.3
Reductions from Recommendation in Scoping Plan	1.7[a]	0.12
2020 Emissions	28.0[a]	3.2

[a] See text: Due to RECLAIM for NOx, we have not counted stationary source NOx reductions here.

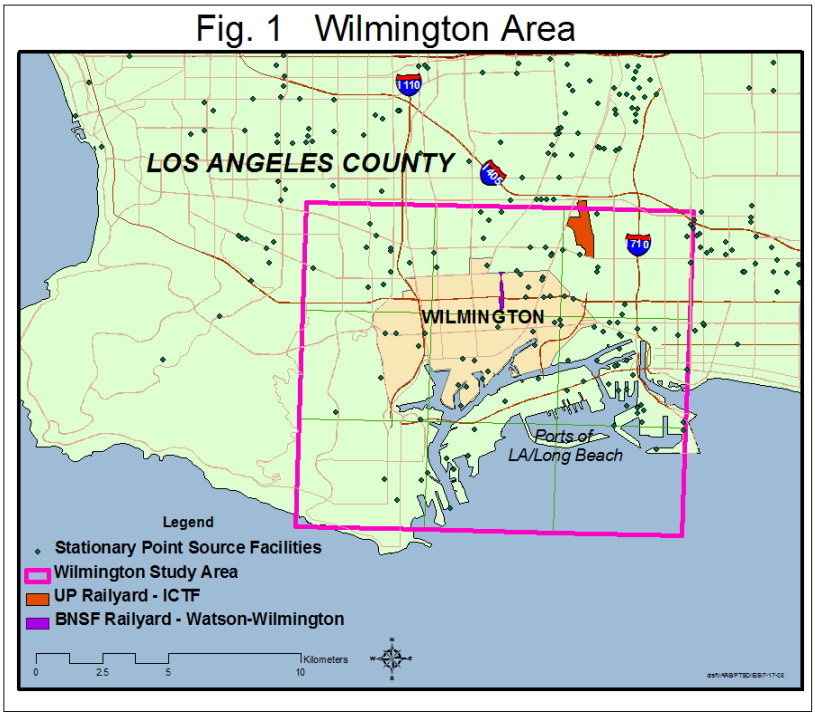
Methods

To illustrate the potential co-benefits of the Scoping Plan to local communities, ARB evaluated projected NOx and PM2.5 emission reductions by 2020 for the community of Wilmington, in the

Los Angeles area. Current emissions were represented by the 2005 SIP modeling inventory. To place the reductions in context, the analysis considers two cases: 2020 reductions due to existing programs and 2007 SIP measures, and 2020 reductions due to the incremental co-benefits from the Scoping Plan. The 2020 emission projections take into account growth, as well as the combined benefits of existing programs and new SIP measures as they apply to emission sources in the Wilmington community.

The Wilmington area in southern Los Angeles County is within the South Coast air basin, and includes a diverse mix of sources: the ports of Los Angeles and Long Beach, major transportation corridors, railyards, refineries, and other industrial/commercial operations. The best available data to characterize base and future year emissions for the full array of source types in this region was the gridded modeling inventory developed by ARB staff for southern California ozone modeling. The modeling inventory includes all mobile, stationary, and area wide source types – all on a spatial grid – for the 2005 base year and for projected 2020 levels. The modeling inventory already incorporates growth factors to account for economic and population growth affecting each sector, and control factors to account for the emission reductions in 2020 due to current regulatory programs, including all the existing programs and 2007 SIP measures. The Wilmington study area for this analysis has been represented as a 12 km by 12 km area, centered on the Wilmington ZIP code 90744, and defined as 9 cells excerpted from the southern California modeling grid domain. The Wilmington "9 cell" area used in this analysis has a population of approximately 300,000 and is shown in Figure H-3.

Figure H-3: Wilmington "9 Cell" Area



For the Wilmington grid study area, the staff compared the modeling inventory 2005 base year with projected 2020 levels of NOx and PM2.5 emissions for two cases:

1. **2020 reductions due to existing programs and 2007 SIP Measures – "before" the Scoping Plan:** This "before" case includes all rules/measures for air pollution control

adopted by December 31, 2006, plus SIP Measures. We collectively refer to this case as the "Existing and SIP Measures" case[100];

2. **2020 reductions due to the additional co-benefits "after" the Scoping Plan:** This "after" case represents the incremental additional criteria pollutant reductions due to co-benefits from the recommended measures in the Scoping Plan.

Reductions in the NOx and PM2.5 as a co-benefit of the Scoping Plan are expected mostly as a result of avoided fuel combustion. For example, improved energy efficiency programs in the electricity sector will result in the need for less fossil fuel combustion for power generation, resulting in concurrent reductions in criteria pollutant emissions.

Some criteria pollutant co-benefits are distributed over wide areas (e.g., reduced diesel and gasoline combustion from vehicles). Other GHG reductions (whether through source-specific regulations or the cap-and-trade regulation) will occur at individual stationary sources (such as efficiency improvements at industrial facilities) or will concentrate at specific sites (such as ports). This example quantification of co-benefits of the Scoping Plan at the community level is done for comparative purposes to illustrate the likely scale of potential co-benefits in the context of existing programs.

NOx and PM2.5 Co-Benefits – "After" Scoping Plan

This analysis of co-benefits from the Scoping Plan measures focuses on the major categories that, due to measures that reduce GHG emissions, are likely to reduce NOx and PM2.5 emissions by the 2020 timeframe, and for which data exist to quantify reduction estimates. (Several other measures are discussed qualitatively.) Many of these criteria pollutant co-benefits are expected due to net reduced/avoided fossil fuel combustion (e.g., through electrification or energy efficiency). In this analysis, approximate percentage-based or fractional-based reductions were estimated for many categories in order to scale the statewide benefits to the particular sources in the localized Wilmington study area. While it is likely that the actual onsite reductions at industrial sources will differ across individual facilities from the assumed uniform 10 percent reduction,[101] the analysis identifies how reductions at these facilities affect the overall level of co-benefits. Given the uncertainties in available information and the type of analysis used, estimated co-benefits could be greater or smaller than estimated here. As individual measures are developed better estimates of co-benefits should be possible.

[100] The "before" case includes what we collectively refer to here as the "Existing and SIP Measures", representing existing programs that focus on direct control of criteria and toxic air pollutants, and reflecting all adopted rules and measures through December 31, 2006, and SIP measures. The "before" case already includes major goods movement measures (ships, port trucks, cargo handling equipment); diesel risk reduction measures; reformulated gasoline and low-sulfur diesel fuel measures; New Source Review and stationary source permitting; the LEV/ZEV program; life-cycle benefits from the initial Pavley I measures for vehicles; consumer products regulations; railroad MOUs; and many other measures. Collectively, the "Existing and SIP Measures" will provide substantial improvements to air quality by 2020, which are greater than – and independent of – the additional co-benefits in the "after" Proposed Scoping Plan case. More information regarding SIP Measure quantification factors can be found in the State Implementation Plan.

[101] The reductions at any one facility could be much greater or lesser than 10 percent. For example, very small or no reductions might occur because available cost-effective industrial emission reductions have already been implemented at a particular site.

Table H-13: Emissions in 2020 Reflecting Existing and SIP Measures and "Before" Scoping Plan – Wilmington Study Area
(tons per day, selected categories)

	NOx	ROG	SOx	PM25
STATIONARY SOURCES				
Electrical Utilities	0.83	0.04	0.01	0.02
Oil and Gas Production (Combustion)	0.06	0.11	0.00	0.00
Petroleum Refining (Combustion)	3.36	0.64	2.00	0.90
Manufacturing and Industrial	0.94	0.10	1.00	0.12
Service and Commercial	0.38	0.09	0.02	0.04
Other Fuel Combustion	0.73	0.02	0.50	0.04
AREA SOURCES				
Oil and Gas Production	0.03	0.14	0.00	0.00
Petroleum Refining	1.92	1.10	4.32	0.36
Petroleum Marketing	0.00	2.58	0.00	0.00
Residential Fuel Combustion	0.15	0.02	0.01	0.02
MOBILE SOURCES				
On-Road Motor Vehicles	3.42	1.78	0.04	0.27
Aircraft	0.02	0.02	0.00	0.00
Trains	0.82	0.06	0.00	0.02
Ships and Commercial Boats	12.9	1.32	1.91	0.42
Recreational Boats	0.06	0.34	0.00	0.03
Off-Road Equipment	1.54	1.05	0.00	0.04
Fuel Storage and Handling	0.00	0.09	0.00	0.00
STUDY AREA TOTAL	**28.5**	**15.3**	**10.1**	**3.3**

The basic approaches for estimating the NOx and PM2.5 co-benefits of the Scoping Plan measures are described in the following sections by category.

Electricity Production

Renewables Portfolio Standard (Measure E-3): The Scoping Plan reflects the goal of increasing California's Renewables Portfolio Standard (RPS) for the mix of power generation to 33 percent by 2020. The increased use of renewables would mean displacement of other electricity generation, primarily combustion-related operations, largely natural gas. Using the California Energy Commission's estimate that about 70 percent of electricity is generated in-state, we assume 70 percent of the benefit will occur in-state. This measure is expected to result in avoided statewide generation (and associated avoided line losses) of approximately 48,000 GWh, which is approximately 13 percent relative to the estimated 2020 total state

generation of 370,000 GWh. For simplicity, we assume for Wilmington the overall 13 percent average in displaced electricity generation (primarily natural gas units).[102]

For power production related to the localized Wilmington study area, the modeling inventory shows the 2020 levels for electric production "before" the Scoping Plan measures to be 0.83 tons per day NOx and 0.02 tons per day of PM2.5 (using the Electric utilities category from Table H-13), resulting in an estimated Scoping Plan co-benefit of 0.076 tons per day NOx and 0.002 tons per day of PM2.5.

Energy Efficiency (Measure E-1) and Million Solar Roofs (Measure E-4): The Scoping Plan considers further energy efficiency improvements in the electricity sector that will decrease demand for electricity (e.g., building/appliance standards, utility energy efficiency programs), and the Million Solar Roofs program. These measures are expected to result in avoided generation (and associated avoided line losses) of approximately 35,000 GWh and 4,800 GWh, respectively, which is approximately 11 percent relative to the estimated 2020 total state generation of 370,000 GWh. Applying the reduction to the electric utility category emissions in the localized Wilmington study area corresponds to a co-benefit reduction of 0.058 tons per day of NOx and 0.001 tons per day of PM2.5.

Combined Heat and Power (Measure E-2): The Scoping Plan considers a statewide usage of 32,000 GWh of combined heat and power (CHP). CHP systems generate electricity and thermal loads at a facility, such as a school, hospital or manufacturing site, replacing onsite thermal generators (boilers) and grid electricity. This replacement results in a net energy savings between a CHP system and a power plant, because the power plant also generates a thermal load but is unable to use it. Additional benefits include avoided line loss for electricity saved. However, this shift can also change the location of co-pollutants, as CHP systems can generate the same, more, or fewer co-pollutants than the power plant, depending on the system's design and operation and on what type of industrial boiler the system is replacing. CHP systems also have a wide range of sizes, so their regulatory requirements can vary, and at this time the specific locations where CHP will be deployed are not known. Because of this uncertainty, we have assumed a shift between power plant and CHP that is neutral, and we have not assumed co-benefits in criteria pollutant reductions from CHP.

Limitations of Analysis: Several caveats should be noted regarding the power production calculations for this analysis. It is difficult to scale both the statewide electricity usage and statewide electricity production accurately to this localized Wilmington study area. The electricity usage may be higher in the region than an average across all other areas, due to the heavy industrial and port-related uses in this region. At the same time, the power production operations (power plants, etc.) associated with "Electric Utilities" that are included in the 9-cell modeling inventory may not correspond exactly to the production locations of the electricity that is consumed in Wilmington. Given the uncertainties, the benefits of greener electricity could be greater or smaller for this region.
A further consideration is that most major stationary source facilities (including power plants) in the South Coast Air Basin are included in the district's RECLAIM program for NOx emissions

[102] This renewable energy analysis assumes that if any new facilities are built, they are either located outside the Wilmington study area or they do not result in a net increase in criteria pollutant emissions compared to the prevailing power production sources already in the area. The estimate of reduced combustion-related electricity generation should be sufficiently conservative to ensure we have not overstated the potential co-benefits of the RPS.

trading. This makes the estimation of Scoping Plan local or even regional co-benefits of NOx reductions from stationary sources in this region more uncertain. Therefore, we have not included any NOx co-benefits estimates from stationary sources.

Residential/Commercial Fuel Combustion

Energy Efficiency (Measure CR-1) and Solar Water Heating (Measure CR-2): The Scoping Plan considers energy efficiency improvements and solar water heating in the residential and commercial fuel combustion area. We have assumed that this would result in a 10 percent reduction in energy demand, and that 90 percent of this would be reduction in natural gas combustion. The modeling inventory categories "Service and Commercial" and "Residential Fuel Combustion" (Table H-13) in the Wilmington 9-cell area together give an estimate of approximately 0.53 tons per day NOx and 0.06 tons per day PM2.5 in the "before" Scoping Plan case. Applying the reduction fractions, we would estimate a Scoping Plan co-benefit reduction of 0.048 tons per day NOx and 0.0054 tons per day PM2.5 in the localized Wilmington area.

Gasoline Measures – On-Road Motor Vehicles

The Scoping Plan considers the benefits from full implementation of AB 1493 Pavley Phase I and Phase II for on-road passenger vehicles (measure T-1). (It assumes eventual authority to implement the AB 1493 regulation or use of other measures such as "feebates" if needed to achieve equivalent reductions.) The base case scenario "before" the Scoping Plan measures has already included some adjustment for life-cycle benefits of the initial Pavley Phase I measures, as included in the Existing and SIP Measures. The additional measures (measures T-3 and T-4) and full implementation of all phases of Pavley (measure T-1), recommended by the Scoping Plan, are estimated to provide an additional 20 percent reduction in gasoline combustion, i.e., beyond what was accounted for in the "before" scenario. Therefore, for this analysis, we have assumed that the Wilmington area would experience this same additional 20 percent reduction in gasoline combustion in the on-road motor vehicle usage and a corresponding 20 percent reduction in emissions.

In the Wilmington 9-cell study area, the emissions from gasoline combustion from on-road passenger vehicles are estimated to be 1.03 tons per day NOx, 0.03 tons per day SOx, and 0.11 tons per day PM2.5.

Applying the 20 percent reduction in gasoline combustion, we estimate a co-benefit reduction of 0.022 tons per day of PM2.5. We have not assumed any NOx reductions, because we allow for the possibility that NOx reductions would be credited toward the LEV regulation. However, NOx reductions could occur. Some additional benefits are expected from avoided fuel delivery emissions, but these would be small for this local analysis and have not been quantified.

Diesel Measures – On-Road Motor Vehicles

The Scoping Plan considers measures that would reduce vehicular diesel combustion emissions, including aerodynamic improvements (measure T-1) and medium/heavy-duty hybridization (measure T-8). We have assumed a 5 percent reduction in diesel combustion in on-road diesel vehicles from these combined measures. In the Wilmington 9-cell study area, the emissions from diesel combustion from on-road motor vehicles are estimated to be 2.2 tons per day NOx, 0.01 tons per day SOx, and 0.1 tons per day PM2.5.

Applying the 5 percent reduction in diesel combustion, we estimate co-benefit reductions of 0.11 tons per day NOx, and 0.005 tons per day PM2.5.

Goods Movement

Many Goods Movement measures are already accounted for in the Existing and SIP Measures, so their benefits are counted in the "before" scenario. This includes rules for port trucks, cargo handling equipment, commercial harbor craft, ocean-going vessel rules such as shore power, and others, and it includes Vessel Speed Reduction provisions, already in place at the Ports of LA/Long Beach.

The Goods Movement efficiency measure (T-6) recommended in the Scoping Plan is additional to the SIP, but has not been developed in enough detail to provide well-defined estimates of co-pollutant benefits. However, the study area contains a very large concentration of goods movement sources, and the potential co-benefit from the recommended measure in the Scoping Plan could be significant. The Scoping Plan considers diverse system-wide efficiency improvements across the whole goods movement sector. It is difficult at this time to characterize exactly what will be achieved in the localized Wilmington area, but they should be substantial. Some of the potential strategies are described below.

Commercial Harbor Craft Education/Outreach for Maintenance and Design Efficiency: The Goods Movement efficiency measure considers improvements in harbor craft efficiency through various measures, the benefits of which are not yet individually quantified. We have not estimated reductions in the Wilmington area, but because the study area includes the ports and railyard activity, co-benefits in reduced NOx and PM2.5 would be expected.

Anti-Idling Measures for Cargo Handling Equipment: The Goods Movement efficiency measure considers reductions in idling emissions for cargo handling equipment at ports and railyards through anti-idling measures, the benefits of which are not yet individually quantified. Because the area includes ports and railyard activity, co-benefits in reduced NOx and PM2.5 would be expected.

TRU Electrification at Distribution Centers and Energy Efficiency Guidelines: The Goods Movement efficiency measure considers measures which would expand on the existing transport refrigeration unit (TRU) ATCM regulations, both with energy efficiency guidelines and limitations on using internal combustion engine power for cold storage at distribution centers and grocery stores. There are cold storage distribution facilities in the Wilmington study area, and there are likely to be NOx and PM2.5 co-benefits for these TRU measures in the area.

Port Trucks: Benefits for the Port Truck rule were already estimated in the "before" case for the Existing and SIP Measures, including a NOx reduction of ~8 tons per day for the South Coast Air Basin, estimated from the Port Truck rule. We are not assuming any additional measures resulting in co-benefit reductions for the "after" Scoping Plan case. However, in the modeling inventory analysis, the benefits due to the Port Truck rule were spatially distributed along with all other heavy-duty trucks using the SCAG heavy-duty truck model. In reality, proportionally more benefits of the ~8 tons per day NOx reduction would be expected to be highly localized near the Wilmington area than are likely to have been captured by the SCAG truck model.

Modeled Co-Benefit Reduction: Although the specific regulations and strategies to improve efficiency in the goods movement sector have not yet been identified, it is reasonable to assume

a 10 percent reduction in emissions from ships, trains, and off-road equipment in the Wilmington study area. This would provide 1.5 tons per day of NOx reductions and 0.05 tons per day of direct PM2.5 reductions. We believe this is a conservative estimate, as the recommended measure in the Scoping Plan assumes a 20 percent reduction in greenhouse gas emissions from goods movement sources by 2020.

Reductions at Industry Facilities

The Scoping Plan identifies 6 measures for various industrial categories. The modeling inventory for the Wilmington 9-cell area identifies numerous point source facilities in the categories of petroleum refineries, oil and gas production, and others. (Cement and glass manufacturing facilities do not occur in the Wilmington area.) The emissions inventory data also identify the processes that are combustion related, such as boilers over 10 MMBtu/hr.

One further consideration is that most major stationary source facilities (including refineries, oil and gas production facilities, and many other major industrial sources) in the South Coast Air Basin are included in the district's RECLAIM program for NOx emissions trading. This makes the estimation of local or even regional co-benefits of NOx reductions from stationary sources in this region more difficult. Therefore, we have not included any NOx co-benefits estimates from any stationary sources in the final totals. (PM2.5 reduction estimates are not affected by RECLAIM.)

Specific source types are discussed further below. For the purposes of this evaluation, it was necessary to make assumptions about potential emission reductions at industrial sources in the Wilmington area. We assumed that industrial sources would achieve greenhouse gas emission reductions through efficiency measures that reduce onsite fuel use by 10 percent, either in response to a cap-and-trade program, due to the results of the facility energy efficiency audits or due to measures to reduce fugitive emissions from oil and gas extraction and refineries, and refinery flaring. While it is likely that the actual onsite reductions will differ across individual facilities from the assumed uniform 10 percent reduction,[103] the analysis identifies how reductions at these facilities affect the overall level of co-benefits. Some information is available about the emission reductions potential and possible cost for of reductions at these sources.

Energy Efficiency and Co-Benefits Audits at Large Industrial Sources (measure I-1): The Scoping Plan recommends the use of audits to identify efficiency improvements to produce cost-effective GHG emission reductions at large industrial sources. The measure is also intended to provide additional information to evaluate whether cost-effective greenhouse reduction measures would also provide criteria pollutant and/or air toxics reductions as a co-benefit. Some level of reduction in NOx and PM2.5 from energy efficiency measures at large industrial facilities in the Wilmington area is likely, but it is not possible to quantify reductions at this time.

Refineries: The Scoping Plan includes three measures that target GHG reductions from the refinery sector. One measure would remove the methane exemption for VOC sources (measure I-5), and the second would reduce flaring (measure I-4). The third measure would place refineries under a cap. In general, the analysis suggests that many refineries could implement efficiency measures (such as boiler replacements or efficiency "tune-ups") that could reduce GHG emissions at relatively low cost. Together, for these measures, a fuel savings on the order

[103] The reductions at any one facility could be much greater or lesser than 10 percent. For example very small or no reductions might occur because available cost-effective industrial emission reductions have already been implemented at a particular site.

of 10 percent seems feasible. If implemented statewide, this could produce a PM2.5 co-benefit on the order of 0.14 tons per day.

In order to illustrate the possible co-benefits of refinery GHG reductions in Wilmington, ARB assumed uniform reductions of 10 percent at each refinery in the study area. The area's four large refineries account for just under 30 percent of the refining capacity in the state, and the potential benefits of a 10 percent improvement in refinery fuel use efficiency could produce about a 0.04 ton per day reduction in PM2.5. No NOx reductions are estimated because each refinery in the area is under the RECLAIM program, so additional NOx reductions at a refinery are likely to be offset by NOx emissions elsewhere at the facility or in the region.

Oil and Gas Extraction: The Scoping Plan recommends regulating fugitive emissions from oil and gas extraction and placing combustion sources in the sector under an emissions cap (measure I-2). For this localized analysis, we have assumed a 10 percent efficiency improvements applied to combustion-related processes at these facilities in the Wilmington study area as a result of the regulation and the cap. The modeling inventory shows approximately 0.06 tons per day NOx and minor PM2.5 from combustion processes occurring at oil and gas production facilities in the Wilmington 9-cell area. Applying a 10 percent factor would result in co-benefit reductions in emissions of 0.006 tons per day of NOx and a minor amount of PM2.5. As discussed above, we are focusing on the PM2.5 reductions, due to RECLAIM considerations affecting NOx from stationary sources.

Industrial Boiler Efficiency and Internal Combustion Engine Electrification: The Scoping Plan would place industrial boilers and engines under an emissions cap. For this preliminary evaluation, we have assumed 10 percent efficiency improvements applied to boilers larger than 10 MMBTU/hr and internal combustion (IC) engines at facilities in the Wilmington study area as a result of the cap. The modeling inventory includes 0.42 tons per day NOx, 0.026 tons per day SOx, and 0.093 tons per day PM2.5 from boilers larger than 10 MMBTU/hr and IC engines occurring at facilities in the Wilmington 9-cell area (other than power plants, refineries, and oil and gas production). Applying a 10 percent reduction factor for these boilers and engines results in estimated emission reductions of 0.042 tons per day NOx, 0.003 tons per day SOx, and 0.009 tons per day PM2.5. As discussed above, we are focusing on the PM2.5 reductions due to RECLAIM considerations affecting NOx.

Summary of Emission Co-Benefits

Table H-14 summarizes the estimated co-benefit emission reductions estimated for the Wilmington study area resulting "after" the Scoping Plan recommended measures.

Table H-14: Estimated 2020 Emission Reduction Co-Benefits "After" Scoping Plan for the Wilmington "9-cell" Study Area
(tons per day)

Category	NOx	PM2.5	Predominant Fuel
Electricity			
Renewables Portfolio	0.076 [a]	0.002	Natural gas
Efficiency & Million Solar Roofs	0.058 [a]	0.001	Natural gas
Combined Heat and Power	[c]	[c]	Mixed
Residential/Commercial Fuel	0.048	0.0054	Natural gas
On-Road Gasoline	-- [b]	0.022	Gasoline
On-Road Diesel	0.11	0.005	Diesel
Goods Movement	1.5	0.05	Diesel
Industrial			
Refineries	*	0.04	Mixed
Oil and Gas	0.006 [a]	minor	Mixed
Boilers & IC Engines	0.042 [a]	0.009	Mixed
Subtotal of calculated reductions	**1.8**	**0.12**	
TOTAL Non-RECLAIM Reductions *	**1.7**	**0.12**	

[a] For stationary sources we focus only on the PM2.5 reductions, due to RECLAIM considerations that affect NOx in the South Coast air basin. See text.
[b] No NOx reductions are assumed from reduced gasoline combustion under Pavley provisions, however, such reductions could occur. See text.
[c] No criteria pollutant co-benefits from this category are assumed to occur in the Wilmington study area since the specific locations and types of changes are not known at this time. See text.

Health Benefit Estimate

As an illustration of the benefits of existing programs and the co-benefits of the climate change Scoping Plan, the reduced health impacts associated with these NOx and PM2.5 emission reductions were considered. The health impacts associated with ozone and PM2.5 range from respiratory effects to premature death. This section discusses the potential decrease in adverse health effects associated with emission reductions that will occur in Wilmington as a result of the Scoping Plan.

The methodology that ARB uses to quantify premature death and other health impacts from exposure to air pollutants is based on a peer-reviewed methodology developed by U.S. EPA. ARB augmented U.S. EPA's methodology by incorporating the results of new epidemiological studies relevant to California's population, including regionally specific studies, as they became available. The methodology was described in ARB's March 2006, *Emission Reduction Plan for Ports and Goods Movement (Goods Movement Plan*), and was updated in the recent staff report for estimating premature death from exposure to particulate matter.[104]

[104] Air Resources Board. *Methodology for Estimating Premature Deaths Associated with Long-term Exposure to Fine Airborne Particulate Matter in California.* October 24, 2008. http://www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf (accessed December 9, 2008)

The co-benefit emission reductions in the study area would produce regional health benefits. A relatively small portion of these benefits would occur in the study area (approximately 300,000 area residents). Health benefits due to reductions in NOx are mostly at the regional levels, since NOx emissions have usually travelled some distance before they are transformed into PM via atmospheric reactions. Point source combustion PM emissions persist in the atmosphere and increase exposures both in the area where they are emitted and broadly throughout the region. Based on previous modeling studies of the impact of port and rail yard PM emissions in the South Coast Air Basin conducted by ARB, PM exposures will be reduced far beyond the study area, and a majority of the health benefits are expected to occur in areas outside of the Wilmington community.[105]

Using the previously described methodology that correlates emission reductions in the air basin with expected regional health benefits there would be approximately 24 avoided premature deaths attributed to emission reductions that occur in Wilmington as a result of the Scoping Plan.

[105] ARB staff analysis indicates that about 20 percent of the health benefits would occur in the Wilmington area.

Overview of Regulatory Programs for Criteria and Toxic Air Pollutants in California

1. Local District Stationary Source Programs

Large industrial sources, such as refineries, factories, and power plants, as well as the smaller retail gasoline service stations, dry cleaners, and bakeries, are known as "stationary sources." The air pollution associated with growth in these stationary sources is addressed in regulatory programs independent of AB32. The following provides background information on how the air pollutant emissions from stationary sources are addressed in California.

Regulatory Structure

The regulation of stationary sources is conducted at three levels of government in California: federal, state, and local. The federal Clean Air Act requires states to directly regulate both stationary and mobile sources through a state implementation plan (SIP) to provide for implementation, maintenance, and enforcement of health-based national ambient air quality standards. The SIP outlines all of the national, statewide, and regional strategies that will be used to meet air quality standards by a given date. At the federal level, U.S. EPA is responsible for implementation of the federal Clean Air Act. Some portions of the Act are implemented directly by U.S. EPA. Other portions are implemented by state and local agencies.

Responsibility for attaining and maintaining ambient air quality standards in California is divided between ARB and the 35 independent local air pollution control and air quality management districts (districts, AQMDs and APCDs). In addition to the federal Clean Air Act, ARB and districts implement requirements of state law including the California Clean Air Act. Both State and federal law address pollutants like ozone and fine particulate matter, as criteria pollutants, and toxic pollutants like benzene and lead, as TACs.

State law vests ARB with direct authority to regulate pollution from mobile sources, fuels, and consumer products. Primary responsibility for controlling pollution from stationary sources lies with the districts. ARB, however, is responsible for submitting plans and maintaining a program that is in compliance with federal regulations, should any district fail to meet its responsibilities. As a result, ARB has an oversight role in assuring district compliance with federal requirements. The federal government retains the exclusive authority to regulate interstate trucks registered outside California, certain new farm and construction equipment, new locomotives, ships, and aircraft.

U.S. EPA, ARB, and the districts work together to complement each other's efforts to achieve clean air. ARB and districts collaborate on many air quality programs throughout California, including the development of the SIPs for achieving the national ambient air quality standards. Those portions of the plans which are federally required are then approved by ARB and subsequently U.S. EPA before becoming part of the federally-required SIP.

The State-to-local delegation of authority to the districts over stationary sources carries with it the responsibilities of developing region-specific rules, permitting, enforcement, collecting data associated with emissions inventory, and the preparation of local air quality plans. The districts may obtain authority from U.S. EPA to be the primary implementing and enforcing agency for certain federal requirements, such as new source performance standards (NSPSs), national emission standards for hazardous air pollutants (NESHAPs), and the prevention of signification deterioration (PSD) program.

Stationary Source Permitting

This section summarizes the primary legal requirements for permitting stationary sources of air pollution in California. Each district has adopted a set of rules to meet State and federal ambient air quality standards. District rules define the procedure and criteria districts use in permitting stationary sources. Although specific rules vary in scope and level of stringency by district depending on the region's air quality status, the general procedure for permitting new and expanding sources is the same throughout the state. Pollutant-emitting sources must obtain an authority to construct before beginning construction, and a permit to operate after the completed facility demonstrates compliance with district rules and the facility's permit conditions. Where applicable, district permit programs incorporate federal stationary source program requirements.

District requirements for stationary sources generally fit into two categories. The first category of rules applied to stationary sources is permitting rules for the construction and operation of new and expanding stationary sources. These rules are referred to as the New Source Review (NSR) program. A second category of requirements is rules which every source, or every source in a certain category of sources, must meet. These are often referred to as prohibitory rules. They apply whether or not a source is new or existing.

New Source Review. The NSR program is the foundation of stationary source emission control in California and allows industrial growth to continue in polluted areas while not undermining progress toward meeting clean air standards. NSR rules apply in areas that do not comply with ambient air quality standards (i.e., nonattainment areas). Because most districts are nonattainment for at least one criteria pollutant, NSR is a key component of stationary source permitting programs. NSR rules regulate new or expanding stationary sources that emit or have the potential to emit any criteria pollutant (or precursor) for which there is a State or federal ambient air quality standard. NSR is intended to allow growth while limiting emissions from new or expanded sources. Therefore, NSR programs provide mechanisms to (1) reduce emission increases up-front through clean technology, (2) provide for a no net increase in emissions, and (3) result in a net reduction in emissions. This is accomplished through two major requirements in each district NSR rule: best available control technology (BACT) and offsets.

> **Best Available Control Technology** is required for new and expanding equipment or processes at stationary sources that result in emission increases above designated thresholds. BACT requires use of the cleanest, state-of-the-art technology to achieve the greatest feasible emission reductions. Significant reductions in criteria pollutants have

been achieved using this strong technology-based approach to air pollution control. For example, BACT emission levels for oxides of nitrogen (NOx) in California are 98 percent less for power plant gas turbines than in 1982 and 91 percent less for gas-fired industrial boilers than in 1983.

In addition to BACT requirements, owners of new or expanding sources may be required to mitigate, or **offset**, the increased emissions that result after installation of BACT. Offsetting is the use of emission reductions from existing sources to offset emission increases from new or expanding sources. The amount of offsets required depends on the distance between the source of offsets and the new or expanding source. Offsets are generally required at a greater than 1-to-1 ratio so that when the new or expanded facility begins operation, more emissions are reduced than are increased. If a source obtains emission offsets outside the local area (i.e., interbasin), or if one type of pollutant is offset against another type (i.e., interpollutant), the source must use air quality modeling to show that these offsets will result in a net benefit. Some districts have pre-established ratios for interpollutant offsets in their rules.

If a stationary source reduces emissions below actual emission levels allowed by the district, in some cases that source may "bank" the reduction in emissions to offset emissions from future projects. Emissions banked in this manner are called **emission reduction credits (ERCs)** and can be used as offsets by the source or sold to other sources. ERCs must meet specific criteria before they can be issued. Criteria include that the actual emission levels reduced be adequately documented via records, emissions are in addition to that which are required by law, and there be mechanisms in place to ensure those reductions continue into the future.

Prohibitory Rules. Each district also has rules aimed at limiting emissions from existing stationary sources, known as prohibitory rules; however these rules apply to new sources as well. Prohibitory rules may be generic, such as limiting the maximum level of a particular pollutant (such as NOx) at any facility, or they may address specific equipment, such as a turbine, a boiler, or a reciprocating internal combustion engine. Sources are also subject to a general nuisance rule which provides authority to the district to control the discharge of any air contaminants that will cause injury, detriment, nuisance, endangerment, discomfort, annoyance, or which have a natural tendency to cause damage to business or property. To date, the 35 districts in total have adopted hundreds of prohibitory rules aimed at reducing criteria and toxic air pollutant emissions. Except where a source is exempt from permit, the proponent of a new or expanding source will normally have to demonstrate compliance with both NSR and prohibitory rule requirements in any permit application submitted to the district.

Toxic Air Contaminant Requirements: Most districts include TAC review coincident with permit review of criteria pollutants. Sources emitting TACs must comply with district requirements regarding the risk assessment and mitigation of TAC emissions. Some districts have established acceptable levels of health risk. Screening analyses and health risk assessments may be performed as part of the permitting process, or as part of the State AB2588 Hot Spots Program. In the case of significant health risks, districts may require

mitigation sufficient to reduce increased risk to tolerable levels. In addition, a new or expanding source, as well as existing sources, may be subject to either a federal NESHAP, a State-mandated airborne toxic control measure promulgated by ARB, or both.

Health Risk Assessment (HRA): As mentioned above, the impacts from any TACs that are emitted from a stationary source project are addressed using a health risk assessment, or HRA. An HRA is an evaluation of the potential for adverse health effects that can result from public exposure to emissions of toxic substances. The information provided in an HRA can be used to decide if or how a project should proceed. Some districts have regulations, or established policies, on HRAs for making risk management decisions. An HRA addresses three categories of health impacts from all pathways of exposure: acute health effects from inhalation only, chronic non-cancer health effects, and cancer risks from multiple exposure paths. Acute health effects generally result from short-term exposure to high concentrations of pollutants. Chronic non-cancer health effects, such as lead intoxication affecting the nervous system, and cancer risks may result from long-term exposure to relatively low concentrations of pollutants.

Air dispersion models are used to predict the ambient air concentrations of the toxic substances emitted by the source. The output from modeling is combined with pollutant-specific factors called unit risk factors (for cancer effects) or reference exposure levels, for acute and chronic non-cancer health effects. Combining this information will provide an estimate of the potential cancer risk (in chances per million) and potential non-cancer impacts expressed as a hazard index. Depending on the results, the district may approve the project as is, require additional pollution controls that represent the best available control technology for reducing toxic emissions (T-BACT), or may reject the project altogether.

Ambient Air Quality Impact Analysis: In California, most district permitting rules require evaluation of the air quality impact of a project to be based on proposed emissions of the project. Rarely will district source permitting rules determine permitting requirements using projections of air quality impacts generated by air quality models. Usually, air quality analyses are only required when emission offsets are not provided. In most cases, only NSR requirements are imposed by California districts since PSD requirements are mostly enforced by U.S. EPA. As a result, air quality modeling is mostly used to demonstrate that the project does not create a new violation of a State or federal ambient air quality standard, or exacerbate an existing one. If there are projected new violations of standards or, in some cases, PSD increments, the project may not be approved, unless acceptable mitigation measures are provided. The project is assumed to meet the net air quality benefit requirement if it complies with all district emission offset requirements. The emission threshold level at which offsets are required varies by district and is in accordance with minimum requirements of the California Clean Air Act.

Federal Program: In addition to the district rules, there are also federal rules which govern the permitting of new or expanding stationary sources—federal NSR and PSD. The purpose of federal NSR is to ensure that air quality does not deteriorate any further in areas with bad air quality (“nonattainment areas”), while PSD ensures that areas with good air quality

will continue to maintain good air quality ("attainment areas"). Many district rules incorporate these federal regulations by reference.

Review of Significant Effects on the Environment

Before the district can issue or deny a permit for a project which may have a significant effect on the environment, the project must comply with the California Environmental Quality Act (CEQA). The purpose of CEQA is to ensure that a project's environmental impacts and alternatives are disclosed to governmental decision-makers and the general public, and that any impacts are mitigated to the maximum extent feasible. CEQA applies to governmental decisions that require the exercise of judgment or deliberation (i.e., "discretionary activities"), as opposed to decisions involving only objective measurements without the use of personal subjective judgment regarding the wisdom or manner of carrying out a project. In addition, CEQA does not apply to statutorily or categorically exempt projects, which are defined in CEQA. Regulatory agencies issue permits after the project has been approved by the lead agency. The lead agency is generally the agency with the broadest discretionary authority in approving the project; this is typically the local land use agency such as a county planning department.

The CEQA Process: If a project is not exempt from CEQA review, it is analyzed to determine if there is the possibility of a significant effect on the environment. If a significant effect is possible, the lead agency prepares an initial study to evaluate the potential for an effect. If there are no potential impacts, a negative declaration is issued by the lead agency. If a potential impact exists which the project proponent can and will commit to mitigate, a mitigated negative declaration can be issued. Otherwise, the lead agency will issue a notice of preparation (NOP) of an environmental impact report (EIR). At this point, responsible agencies may comment on the required content of the EIR. These comments are then used by the lead agency to produce a draft environmental impact report (DEIR). The purpose of a DEIR is to assess any significant effect on the environment by the project and to evaluate potential mitigation measures. This report is available for review by responsible agencies and the public during the public review period. Comments on the DEIR by any of these parties may be submitted prior to the end of the public review period on such topics as completeness and accuracy of the draft EIR. The lead agency then reviews these comments and prepares a final EIR with responses to comments on the draft EIR. The final EIR is used by the lead agency in approving the project and by responsible agencies in issuing permits.

CEQA analyses must consider: impacts of facility construction; indirect emissions from increased mobile source activity; and the cumulative impacts of projects within the area. For example, construction impacts might include fugitive dust emissions raised by mobile construction equipment. Indirect emissions may include emissions from trips to and from work by employees as well as increases in emissions from commercial vehicles using the facility. Cumulative effects means the individual effects from the project are considered with the effects of past projects, other current projects, and reasonably foreseeable future projects. If there is a significant impact, the lead agency will evaluate the need for mitigation measures identified in the EIR before approving the project.

2. Statewide Programs

Efforts at the state level supplement local district stationary source permitting programs through activities that target the reduction of air toxics and criteria pollutants at both stationary and mobile sources. With respect to air toxics, the process of identifying and developing regulations to reduce the public health risks from TACs is led by ARB through a comprehensive statewide Toxic Air Contaminant Program. State-level mobile source programs assist in reducing the localized air quality impacts of stationary sources, as mobile source emissions associated with traffic to and from and within stationary sources can be significant—particularly with stationary sources that serve as transportation hubs such as distribution centers, ports, and rail yards. The major State programs are described below.

Air Toxics Program

California's air toxics program began in 1983 with the adoption of the Toxic Air Contaminant Identification and Control Act. The goal of the air toxics program is to protect the public health. Since 1990, the estimated cancer risk from toxic air pollutants, measured statewide, has been reduced by 45 percent even though California has had significant growth in the number of motor vehicles and industry.

To decide what toxic air pollutants are the most important, ARB has a comprehensive process to prioritize the identification of substances and to develop control measures. ARB conducts research and uses the most up-to-date scientific information on the chemicals used in California's industry and commerce. Based upon reviews of exposure and health effects information, ARB identifies the priority toxic air pollutants that pose the greatest health threat. While there are thousands of chemicals emitted into the air, ARB's ongoing review ensures resources are focused on control actions that most benefit public health. The Air Toxics Program has indentified almost 200 substances which are hazardous to the people of California, and the list continues to grow. Among those listed are asbestos, environmental tobacco smoke, and, diesel particulate matter (diesel PM).

Control measures that reduce TACs (known as airborne toxic control measures, or ATCMs) adopted by ARB have resulted in significant reductions of toxic emissions. These ATCMs require stringent controls and in some cases, complete elimination of the use of the toxic air pollutants through pollution prevention. For ATCMs that apply to stationary sources, the districts typically adopt the State control measure into their own rules. To date, ARB has adopted 17 non-diesel PM toxic control measures that reduce the health impacts from both mobile and stationary sources. These measures include reducing chromium emissions from decorative chrome plating facilities, reducing benzene from retail gasoline service stations, prohibiting the sale and use of automotive coatings containing hexavalent chromium or cadmium, and prohibiting the use of asbestos-containing rock on unpaved roads.

Another component of California's air toxics program is the AB2588 Air Toxics "Hot Spots" program, which requires facilities to report their air toxics emissions. Facilities with emissions that pose a significant risk to public health must notify the local community of the potential risk and then take steps to reduce that risk.

Diesel Program

Particulate matter from diesel-fueled engines (diesel PM) contributes over 70 percent of the known risk from air toxics today and is the most common airborne toxic that Californians breathe. In addition, diesel PM is a significant fraction of the state's particulate pollution problem. In September 2000, ARB adopted an aggressive plan to require cleaner diesel fuel and cleaner diesel engines and vehicles. The Diesel Risk Reduction Plan will reduce diesel emissions from year-2000 levels by 75 percent by 2010 and 85 percent by 2020. This plan will retrofit new and existing engines with PM filters to reduce emissions. A major component of the plan calls for extensive use of low-sulfur diesel fuel. Traffic at industrial facilities, such as the trucks that deliver raw materials and remove products and waste, can be a large contributor to the impact of an industrial facility on a community. The Diesel Risk Reduction Plan is reducing emissions from diesel engines, thereby reducing the contribution from diesel trucks and engines. Since the adoption of the Diesel Risk Reduction Plan, some of the strategies in place today in reducing diesel PM include:

Cleaner diesel fuel: California's diesel fuel is the least polluting in the nation. In 2003, ARB adopted a new regulation lowering the sulfur content of diesel fuel to enable the use of advanced emission control technologies for diesel engines, such as diesel particulate filters. The sulfur level in diesel fuel was lowered to less than 15 parts per million in July 2006. California's fuel regulation applies to on-road, off-road, and stationary engines, while the federal low sulfur diesel rule applies only to on-road vehicles.

Cleaner new diesel engines: In 2001, ARB adopted new PM and NOx emission standards to clean up new on-road diesel engines that power big-rig trucks, trash trucks, delivery vans, and other large vehicles. The new PM standard is a 90 percent reduction from the existing PM standard. With respect to new off-road diesel engines, ARB has worked closely with U.S. EPA on developing new PM and NOx standards for engines used in off-road equipment such as backhoes, graders, and farm equipment. U.S. EPA has proposed new standards that would reduce the emissions from off-road engines to levels similar to the on-road engines by 2010 to 2012.

Cleaner in-use diesel engines: ARB has adopted regulations aimed at reducing PM and other pollutants from in-use diesel engines. The regulations generally rely on the following approaches to significantly reduce emissions from diesel engines: (1) replace the existing engine with a new diesel engine; (2) apply an ARB-verified diesel emission control system to the existing engine and fuel system (includes alternative fuels); (3) replace the vehicle with an alternative-fueled vehicle or a vehicle with a new, cleaner diesel engine; and (4) operational modification (includes reduced operating time, reduced idling, or use of electric power). Some of the specific regulations adopted by ARB are listed below:

- Requirements for Stationary Diesel Agricultural Engines (2006)
- Ocean-going Ship Auxiliary Engines (2005)
- Public and Utility Diesel Truck Fleets (2005)
- Heavy-duty Diesel Truck Idling Technology (2005)
- Commercial Motor Vehicle Idling Restrictions (2004)
- Transport Refrigeration Units (2004)
- Portable Engines (2004)

- Stationary Engines (2004)
- Waste Collection Trucks (2003)
- School Bus Idling Restrictions (2002)

Goods Movement Program. Air pollution from international trade and all goods movement in California is a major public health concern at both regional and community levels. Goods movement is now the dominant contributor to transportation emissions in the state. In April 2006, ARB approved the *Emission Reduction Plan for Ports and Goods Movement* in California to reduce the emissions and health risk in communities near ports, rail yards, and high-traffic corridors. The plan will reduce emissions of diesel PM, the NOx and sulfur oxides (SOx) that contribute to fine particles, and, to a lesser extent, the volatile organic compounds (VOCs) that mix with NOx in the atmosphere to form regional ozone. The plan envisions emission reductions at each step in the goods movement path—from ship to shore to truck or locomotive to the final destination. Plan strategies, as well as some near-term actions already taken at the state level, are described below:

> **Goal for Ships—Reduce today's emissions of diesel PM by half, NOx by one-third, and SOx by 80 percent by 2020**. The plan seeks to reduce emissions from all cargo and passenger vessels operating in California ports and up to 24 nautical miles from the California coast. Ship strategies include cleaner engines and fuels for main and auxiliary engines, expanded speed reduction near the coast, and shore-based electric power in port. In 2007, ARB adopted a regulation estimated to reduce hotelling diesel PM and NOx emissions from container ships, passenger ships, and refrigerated cargo ships by nearly 50 percent in 2014 and 75 percent in 2020. The emission reductions will occur in areas at and near ports where community impacts are of most concern.
>
> **Goal for Trucks—Reduce today's emissions of diesel PM and SOx by 85 percent and NOx by two-thirds by 2020**. The plan focuses on the heaviest diesel trucks capable of hauling cargo containers or substantial bulk goods. Introduction of 2010+ trucks with advanced technology will continue the decline in emissions. Cleaning up the older truck fleets (including the short-haul trucks serving ports), reducing traffic congestion and idling, routing trucks away from neighborhoods, and providing the cleanest diesel fuel are components of the overall truck strategy. Recent ARB actions include anti-idling rules, controls for refrigeration units, more inspections in communities, low sulfur fuel, and software upgrades for 1993-1998 trucks. In 2007, ARB adopted a regulation that establishes emission standards for in-use, heavy-duty diesel vehicles that transport cargo to and from California's ports and intermodal rail facilities.
>
> **Goal for Locomotives—Reduce today's emissions of diesel PM and NOx by over 80 percent, and SOx by 99 percent by 2020**. The plan seeks to reduce emissions from locomotives pulling cargo and passenger trains, both at rail yards and in long-haul service throughout California. Locomotives are subject to federal standards and two agreements negotiated with ARB in 1998 and 2005 that include phase-out of non-essential idling, and preparation of new health risk assessments for 16 major rail

yards and implementation of mitigation measures based on those results. Low sulfur fuels are being phased in, starting in 2007. Idling limits and inspection programs are already reducing diesel PM at rail yards by 20 percent. As U.S. EPA has the sole authority to adopt and enforce locomotive emission standards, ARB has been encouraging U.S. EPA to expeditiously require the introduction of the next generation (Tier 3) of locomotive emission standards.

Goal for Harbor Craft—Reduce today's emissions of diesel PM and NOx by roughly 70 percent by 2020. The plan addresses all commercial harbor craft (tugs, ferries, and fishing vessels) operating out of California ports. U.S. EPA requires 30-45 percent control on new harbor craft and ARB is requiring low sulfur diesel fuel as of 2007. In 2007, ARB adopted a regulation that establishes new and in-use engine emission standards for both auxiliary and propulsion diesel engines on ferries, excursion vessels, tugboats, and towboats.

Goal for Cargo Handling Equipment—Reduce today's emissions of diesel PM by over 95 percent and NOx by over 80 percent by 2020. Cargo handling equipment is used to move goods at ports and intermodal rail yards. In 2005 and 2006, ARB adopted two rules to clean up new and existing diesel equipment and gas forklifts. As an example, the diesel rule requires that all yard trucks be replaced with new, very low diesel PM engines (or cleaner alternative fuels), most within the next five years.

ARB received $1 billion from Proposition 1B, the *Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006*, to reduce emissions from activities related to goods movement along California's four major trade corridors. These funds are allocated to high pollution areas to reduce the public health impacts of goods movement activities.

Appendix I: Measure Documentation

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Measure Documentation

The purpose of this appendix is to document the assumptions and calculations Air Resources Board staff (ARB or staff) used as the basis for greenhouse gas (GHG) emissions reduction measures in the Scoping Plan and Appendices. ARB developed the measures contained herein with technical help from other State agencies and the Climate Action Team subgroups.

General assumptions common to categories of measures or sectors are listed under the major headings below. Unless otherwise noted, cost for a measure is the sum of the annualized capital cost and program maintenance costs. Annualized Capital Cost is defined as the product of the capital expenditure and the capital recovery amortized over a specified period of time at an annual discount rate of 5%. The capital recovery factor (CRF) is calculated using the formula:

$$\text{Capital Recovery Factor} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where i is the discount rate (5%) and n is the life of the capital. A real discount rate of 5% is chosen to match the rate of return on an inflation adjusted 10-year treasury security. The expected life of the capital is estimated for each measure. The amortization period is related to the expected life of the capital or an estimate of the period over which GHG reductions are expected. For example, measures that use a 20-year capital life, the CRF is 0.08024 or approximately $0.08 annually for each dollar of capital expenditure. Each measure described specifies the estimated capital life and associated CRF.

Savings are generally calculated from reduced energy used as a result of efficiency or other measure. For most measures the savings value listed in the tables results from a reduction in fuel or electricity use or the net reduction associated with fuel switching. In the Scoping Plan Appendix C the "Net Annualized Cost" is calculated by subtracting the savings from the annualized cost. A negative cost value indicates the measure is expected to have net savings.

In addition to documentation for the recommended measures, this appendix includes documentation for other measures that were used in the economic modeling as a surrogate for the types of reductions that would be made under the cap-and-trade program. The use of these measures in the economic modeling is discussed in Appendix G. The additional measures include the additional energy efficiency and several Industrial measures.

The values and assumptions documented here are preliminary and subject to change during the regulatory process.

Transportation

General Assumptions

For transportation measures that reduce fuel combustion, staff used 8.94 $kgCO_2E$/gallon (0.00894 $MMTCO_2E$/million gallons) of gasoline and 10.4 $kgCO_2E$/gallon (0.0104 $MMTCO_2E$/million gallons) of diesel in 2020. These GHG emission factors were also employed in developing the emissions inventory. The cost for fuel in 2020 is projected at $3.673 for gasoline and for $3.685 for diesel[106].

Measure T-1—Pavley I and II – Light-Duty Vehicle Greenhouse Gas Standards (Adopted Regulation)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Pavley (AB 1493)	31.7	1,372	11,381	-10,009
Pavley II – Light-Duty Vehicle GHG Standards		594	1,643	-1,049

Overview

This measure reduces GHG emissions from passenger vehicles, based on a fleetwide average, through technological efficiency improvements to vehicles or other actions. The Pavley standards (Pavley I) regulate passenger vehicle GHG emissions starting with the 2009 model year and continuing through 2016. The second phase of the Pavley regulations (Pavley II) is expected to affect model year vehicles from 2016 through 2020.

Assumptions for GHG Emissions Reduction

The Pavley standards are estimated to achieve a reduction of approximately 27.7 $MMTCO_2E$ in 2020[107] resulting from a reduction of approximately 3.1 billion gallons of gasoline consumed statewide in 2020.

$$3098 \text{ Million gallons gasoline} \times 0.00894 \frac{MTCO_2E}{\text{gallon gasoline}} = 27.7 MMTCO_2E$$

The second phase of Pavley targets an additional 4 $MMTCO_2E$ starting with 2016 model year vehicles[108].

$$447 \text{ Million gallons gasoline} \times 0.00894 \frac{MTCO_2E}{\text{gallon gasoline}} = 4 MMTCO_2E$$

[106] Fuel costs are California specific from the California Energy Commission Transportation Energy Forecasts for the 2007 Integrated Energy Policy Report; http://www.energy.ca.gov/2007publications/CEC-600-2007-009/CEC-600-2007-009-SF.PDF page B-5. Costs are 2007$

[107] A detailed analysis of the Pavley standards is found at: http://www.arb.ca.gov/regact/grnhsgas/grnhsgas.htm

[108] More information is fount at: http://www.arb.ca.gov/cc/ccms/reports/final_pavleyaddendum.pdf

Assumptions for Costs and Savings

The average cost for control for passenger cars and small trucks/SUVs is estimated at $1050 for 2016 model year vehicles based on staff analysis[2]. The second phase of the Pavley regulations is expected to be approximately twice the average cost of a 2016 vehicle by 2020, or $2100. Fleetwide aggregate costs per vehicle ranging from $33-1910 (2009-2020 model years) for an estimated 1.3 million vehicles per year is annualized over 16-19 years resulting in $1,236M (in 2004$). Multiplying by a Consumer Price Index of 1.11 results in $1,372M in 2007$. For Pavley II the costs/vehicle are estimated at twice the average 2016 value for Pavley I. This results in $594M in cost for 1.3M vehicles annually.

Savings is calculated based on reduced fuel consumption multiplied by $3.673/gallon of gasoline as described above. Savings are based on 27.7MMTCO_2E and 4 MMTCO_2E for Pavley I and II, respectively.

$$3098 \text{ Million gallons gasoline} \times \frac{\$3.673}{\text{gallon gasoline}} = \$11{,}381\,M$$

$$447 \text{ Million gallons gasoline} \times \frac{\$3.673}{\text{gallon gasoline}} = \$1{,}643\,M$$

Measure T-2—Low Carbon Fuel Standard

GHG Reduction Measure	Potential 2020 Reductions MMTCO_2E	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Low Carbon Fuel Standard	15	11,000	11,000	0

Overview

This measure reduces GHG emissions by requiring a low carbon intensity of transportation fuels sold in California by at least 10% by the year 2020. The low carbon fuel standard regulation is under development and the reduction pathways are being analyzed.

Assumptions for GHG Emissions Reduction

The total projected transportation inventory for fuels affected by the LCFS regulation is approximately 215 MMTCO_2E. This estimate derives from the difference between the total transportation inventory (225.4 MMTCO_2E) and the portion of this inventory that is not affected by LCFS (approximately 10 MMTCO_2E of aviation, residual fuel oil and lubricants). Assuming that vehicle efficiency (Pavley I and II), land use, and goods movement efficiency measures reduce fuel use, the new projected inventory is approximately 167.9 MMTCO_2E with these reductions subtracted. A 10% carbon intensity reduction is therefore 16.8 MMTCO_2E (i.e. 0.1 x 167.9 = 16.8 MMTCO_2E). Because the calculated LCFS GHG emissions reduction has potential overlap with other transportation measures staff discount the calculated reduction of 16.8 MMTCO_2E by 10% to result in a 15 MMTCO_2E reduction for accounting purposes (i.e. 16.8 MMTCO_2E x 0.9 (90%) = 15 MMTCO_2E).

Assumptions for Costs and Savings

Staff assumes the costs of producing ethanol and biodiesel are highly competitive with the current and projected high prices of gasoline and diesel. Staff assumes that implementation of the LCFS will result in displacing approximately 20% of traditional petroleum derived products and replacing them with alternative fuels. This equates to approximately three billion gallons per year reduced consumption of traditional gasoline and diesel that the consumers would buy (savings) and equates to $11 billion dollars in lost sales of petroleum products. Secondarily, staff assumed that alternative fuels could be produced at prices at or below the pretax wholesale cost of petroleum fuels on an energy equivalent basis. Consumers would not necessarily get this benefit as the market price commanded by the alternative fuels would simply be the price of petroleum based products. Recovery of capital expenditure to produce alternative fuels would be recovered from the purchase of $11 billion worth of alternative fuels that replace the petroleum fuels that were displaced (costs). Therefore, staff estimates that there will be no net difference in the costs of producing fuels to meet the LCFS compared with the cost of producing traditional petroleum gasoline and diesel.

Measure T-3—Regional Transportation-Related Greenhouse Gas Targets

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Regional Transportation-Related Greenhouse Gas Targets	5	500	2,054	-1,554

Overview

This measure would reduce vehicle miles traveled (VMT) by approximately 4% through land use planning. Staff estimated a 4% reduction based on review of modeling literature[109].

Assumptions for GHG Emissions Reduction

A 4% reduction in VMT results in a 4% reduction in GHG emissions based on the affected portion of the emissions inventory. Passenger vehicles are projected to emit 160.8 $MMTCO_2E$ in 2020 which derives primarily (99.8%) from gasoline combustion. Measures in the Scoping Plan that reduce GHG emissions from reduced fuel consumption include Pavley I and II (measure T-1 reduces GHG emissions by 31.7 $MMTCO_2E$), vehicle efficiency measures (T-4 reduces GHG emissions by 4.5 $MMTCO_2E$) and high speed rail (1 $MMTCO_2E$). Subtracting the T-1, T-4 and T-9 reductions from the projected inventory results in approximately 124 $MMTCO_2E$ net GHG emission for passenger vehicles. A four percent reduction equates to 4.94 $MMTCO_2E$ which is rounded to 5 $MMTCO_2E$.

[109] Rodier, Caroline, UC Berkeley, Transportation Sustainability Research Center, *"A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions," August 2008.* http://www.arb.ca.gov/planning/tsaq/docs/rodier_8-1-08_trb_paper.pdf

$$160.8MMTCO_2E - 31.7MMTCO_2E - 4.5MMTCO_2E - 1MMTCO_2E = 123.6MMTCO_2E$$

$$123.6MMTCO_2E \times 0.04(4\%) = 4.94MMTCO_2E$$

Note that the order in which the reductions are calculated changes the resulting expected GHG reduction for this measure. For example, if a 4% reduction in VMT were calculated from the business-as-usual projection of 160.8 $MMTCO_2E$, a GHG emissions reduction of more than 6.4 $MMTCO_2E$ would result (i.e. 0.04 [4%] x 160.8 $MMTCO_2E$ = 6.4 $MMTCO_2E$).

Assumptions for Costs and Savings

Staff conservatively estimates $100/ton of carbon reduced for costs and savings are based upon reduced fuel consumption. For 5 $MMTCO_2E$ this is a total cost of $500M. Savings is the result of reduced fuel use.

$$4.94MMTCO_2E \times \frac{1 \text{ gallon gasoline}}{0.00894MTCO_2E} = 553 \text{ million gallons gasoline}$$

$$553 \text{ million gallons gasoline} \times \frac{\$3.673}{\text{gallon}} = \$2{,}054M$$

Measure T-4—Vehicle Efficiency Measures

Includes Tire Pressure Program, Tire Tread Standard, Low-Friction Engine Oils, and Solar-Reflective Automotive Paint and Window Glazing. These measures are assumed to apply primarily to light-duty gasoline passenger vehicles. Vehicle population estimates that staff assumes to be affected by each measure are listed separately below. These measures are expected to primarily affect the light-duty vehicle fleet, however each measure assumes a specific targeted portion of this fleet based on staff engineering judgment.

Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($ Millions)	Savings ($ Millions)	Net Annualized Cost ($ Millions) [Cost-Savings]
Tire Pressure Program	0.55	152	224	-72
Tire Tread Standard	0.3	0.6	123	-123
Low Friction Engine Oils	2.8	520	1,150	-630
Solar Reflective Automotive Paints and Window Glazing	0.89	360	366	-6

Tire Pressure Program

Overview

This measure would increase vehicle efficiency by assuring properly inflated automobile tires to reduce rolling resistance. A proposed Tire Pressure Measure (Measure) would require all automotive service centers and test-only smog check service centers in California

to perform mandatory tire pressure inspections on vehicles being serviced at the facility and further requires that the tires be inflated to the manufacturer recommended levels. Increasing fuel efficiency reduces GHG emission by consuming less fuel.

Assumptions for GHG Emissions Reduction

1) The USEPA estimates that 54 percent of passenger cars and 62 percent[110] of light-duty trucks have under-inflated tires, of which:
    a. Twenty percent of passenger cars and 26 percent of light-duty trucks have severely under-inflated tires (6 pounds per square inch [psi] or more) that average 8.65 psi and 8.49 psi below the vehicle manufacturer's recommended specification respectively.
    b. Twenty-seven percent of passenger cars and 29 percent of light-duty trucks have moderately under-inflated tires (between 1 and 6 psi) that average 3.42 psi and 3.55 psi under-inflation respectively.
2) Fuel efficiency is reduced by 1 percent for every 3 psi of underinflation[5] (average of all 4 tires).
3) Tires lose pressure at a rate of approximately one psi per month[111]
4) A quarterly re-inflation period is assumed due to extensive outreach promoting regular tire inflation checks and the regulation affecting vehicles through automotive repair facilities.

Staff assumes that starting in the first year following the Program's regulatory and outreach components all vehicles with severely or moderately underinflated tires will have their tires properly inflated. Vehicles with underinflation of 1 psi or less are excluded from calculation assuming that this modest measurement variation arises from ambient temperature fluctuation or error in pressure gauges. Staff estimates that 47 percent of passenger cars and 55 percent of light-duty trucks will have moderately underinflated tires through 2020 averaging 3.42 psi and 3.55 under-inflation. Taking into account the air loss rate per month over a 3 month period, the average pressure correction of a tire inflated an additional 3.42 psi and 3.55 psi are 1.92 psi and 2.05 psi respectively (i.e. 0.649% and 0.693% efficiency increase) The 2020 light-duty GHG emissions inventory is 160.7 $MMTCO_2E$ from an expected 18 billion gallons of gasoline. In 2020, the measure is expected to save 0.55 $MMTCO_2E$ from an expected savings of 61 million gallons of gasoline.

<u>Passenger Cars</u>

$$8 \text{ billion gallons gasoline} \times 0.00649(\text{efficiency}) \times 0.47(47\% \text{ of vehicles}) = 24 \text{ million gallons gasoline}$$

[110] U.S. Environmental Protection Agency, Office of Transportation and Air Quality Fuel Economy Labeling of Motor Vehicle Revisions to Improve Calculation of Fuel Economy Estimates, EPA420-R-06017, December 2006.
[111] Bridgestone Firestone North American Tire, LLC website: www.tiresafety.com
Michelin North America, Inc. website: http://www.michelinman.com/tire-care/tire-saving-tips/air-pressure-tips/

$$24 \text{ million gallons gasoline} \times 0.00894 \frac{MTCO_2E}{\text{gallon}} = 0.22 MMTCO_2E$$

Light-Duty Trucks

$$9.7 \text{ billion gallons gasoline} \times 0.00693 \times 0.55 = 37 \text{ million gallons gasoline}$$

$$37 \text{ million gallons gasoline} \times 0.00894 \frac{MTCO_2E}{\text{gallon}} = 0.33 MMTCO_2E$$

Assumptions for Costs and Savings

Staff estimates costs associated with air compressors, air tools, tire gauges, equipment maintenance and Tire Guide/Yearbook. Cost assumptions for each affected facility are:

1) Air compressors are an average cost of $468 with a life expectancy of five years. Staff estimates that test-only smog check facilities will have to purchase an average of 1.5 compressors in 2010, 2015 and 2020.
2) Annual compressor maintenance at an average of $37.50.
3) Air tools and hoses are $50 every two years ($25/year).
4) High quality tire pressure gauge is $25 with a 2-year life expectancy.
5) Tire Guide/Yearbook is approximately $50 with a 3 year replacement need.
6) The number of test-only smog check facilities is 1,985 and automotive repair facilities is 33,692 (including test-only smog check facilities).[112]
7) Staff expects that one or two compressors and associated equipment will be purchased per test-only facility.
8) The estimated time to check and inflate tires is expected to be 3 minutes per vehicle at an average labor rate of $19.63/hour.
9) Eighty-two percent of drivers have their vehicle oil changed by professionals.[113]
10) Staff expects that the per-vehicle labor costs will be passed on to the consumer.

To calculate the 2020 annualized cost, staff uses the above assumptions and the capital recovery factor for either 2, 3 or 5 year amortization period (depending on capital expenditure). The result is an annualized cost of $152M and net annualized cost savings of $72M in 2020. Savings is the result of reduced fuel use (61 million gallons of gasoline at $3.673/gallon), which is $224M.

[112] California Department of Consumer Affairs, Bureau of Automotive Repair, Vehicle Information Database
[113] California Integrated Waste Management Board, Used Oil Source Reduction Study: *Busting the 3000 mile myth*, March 2007.

Calculation	Cost ($Millions)
Smog stations	
Capital cost in 2020 - Compressors	$1,531,516
2020 annualized capital cost using 5 year CRF (0.23097 x capital cost)	$353,741.54
Capital cost 2020 - Hoses	$245,435
2020 annualized capital cost using 3 year CRF (0.3672 x capital cost)	$90,125.91
Capital cost 2020 – Tire Guide Book	$109,082.32
2020 annualized capital cost using 3 year CRF (0.3672 x capital cost)	$40,055.96
Total capital cost for 2020 (sum of annualized costs)	$483,923.42
Operating cost 2020	$87,265.85
Total smog check cost for 2020	$571,189.27
Automotive Service Centers	
Capital cost in 2020 - Gauges	$888,654
2020 annualized capital cost using 2 year CRF (0.5378 x capital cost)	$477,922.65
Capital cost 2020 - Tire Guide Book	$1,742,459.52
2020 annualized capital cost using 3 year CRF (0.3672 x capital cost)	$639,846.06
Total automotive center cost for 2020	$1,117,768.71
Total Annual Labor Cost for 2020	$150,163,116
Total cost for 2020	$151.9
Total savings 2020 (61,000,000 gallons gasoline x $3.673/gallon)	$224.1

Tire Tread Standard

Overview

This measure would increase vehicle efficiency by creating an energy efficiency standard for automobile tires to reduce rolling resistance. A reduction in GHG emissions results from reduced fuel use. Staff estimates that reducing the rolling resistance of tires by 10% results in a 2% increase in fuel efficiency.

Assumptions for GHG Emissions Reduction

The tire tread program will provide information to consumers about the availability of tires which are identified as low rolling resistance. Staff uses the following assumptions in calculating the GHG reduction from this measure:

- In 2020, there will be approximately 25 million passenger vehicles in the fleet affected by this measure.
- Approximately 5.5 million vehicles are new and therefore not in the market to purchase new tires.
- New vehicles have low rolling resistance tires as original equipment from the vehicle manufacturer.

- Passenger vehicles affected by this measure drive an average of approximately 12,000 miles per year.
- The fleet average mileage for passenger vehicles affected by this measure is approximately 21 miles per gallon.
- Approximately 15% of tire purchases will be low rolling resistance (i.e. 15% market penetration)
- A 10% reduction in rolling resistance results in a 2% vehicle efficiency increase.

$$19{,}500{,}000 \text{ vehicles} \times 15\% = 2{,}925{,}000 \text{ vehicles} \times 12{,}000 \text{ miles} = 35{,}100{,}000{,}000 \text{ VMT}$$
$$35{,}100{,}000{,}000 \text{ VMT} \div 21 \text{ MPG} = 1{,}671{,}428{,}571 \text{ gallons} \times 2\% = 33{,}500{,}000 \text{ gallons}$$
$$33{,}500{,}000 \text{ gallons} \div 0.00894 MMTCO_2E / \text{million gallons} = 0.3 MMTCO_2E$$

Assumptions for Costs and Savings

Staff estimates that the there is little, if any, cost differential between tires of varying rolling resistance and therefore assumes no additional cost for choosing low rolling resistance tires. The annual program cost is estimated at $625,000 based on staff experience with programs of similar size and scope. Savings is the result of reduced fuel use.

$$33.5 \text{ million gallons gasoline} \times \$3.673 / \text{gallon} = \$123M$$

Low Friction Engine Oils

Overview

This measure would increase vehicle efficiency by mandating the use of engine oils that meet certain low friction specifications. The American Petroleum Institute has established "energy conserving designation" for certain oils. These specifications would be used as a starting point for the mandated oils under this measure.

Assumptions for GHG Emissions Reduction

Staff estimates a 2% efficiency increase based on results from research studies.[114] Staff estimates the efficiency will be achieved in about 85% of vehicles comprising the light-duty fleet. The 2020 GHG emissions inventory from light-duty vehicles is 160.8MMTCO$_2$E for all fuels.

$$0.02 \times 0.85 \times 160.8 MMTCO_2E = 2.8 MMTCO_2E$$

Assumptions for Costs and Savings

Staff estimates approximately $20 per vehicle additional operating and maintenance costs for 26 million vehicles affected by this measure in 2020. Existing oils meeting the low friction criteria are approximately $1/quart more than conventional oil. The $20 incremental cost is

[114] The Southwest Research Institute (SwRI) conducted a research program that evaluated the effect of engine oil on the fuel economy of gasoline and light-duty diesel engine passenger cars called the Mercedes-Benz M111 Fuel Economy Test—DCED L-54-T-96(http://www.swri.org)

based on use of 5 quarts of engine oil at $1 per quart additional for each of 4 oil changes per year. Savings is the result of reduced fuel use of 313 million gallons of gas at $3.673/gallon.

$$\$20 \times 26 \text{ million vehicles} = \$520M$$
$$\$3.673/\text{gallon} \times 313MG = \$1{,}150M$$

Solar Reflective Automotive Paint and Window Glazing

Overview

This measure would increase vehicle efficiency by reducing the engine load for cooling the passenger compartment with air conditioning. The use of solar reflective automotive paints and window glazing reduces heating of the automobile passenger compartment from the sun resulting in reduced air conditioning use. The result is both less frequent air conditioning use by drivers and smaller air conditioners specified by manufacturers for new vehicles.

Assumptions for GHG Emissions Reduction

Staff estimates approximately 170 million gallons of gasoline could be saved annually with full implementation of this measure based on results from a National Renewable Energy Laboratory research study and associated modeling results.[115] This translates into 1.5 $MMTCO_2E$. This measure is expected to affect 2012 and newer vehicles that are expected to comprise 43% of the 2020 fleet and account for 59% of VMT according to EMFAC2007[116]. The result is a reduction of 0.89 $MMTCO_2E$ in 2020.

$$0.59 \times 1.5MMTCO_2E - 0.89MMTCO_2E$$

Assumptions for Costs and Savings

Staff estimates that the additional cost per vehicle is approximately $250 for complying with this regulation. This includes $10-50/vehicle additional cost for solar reflective paint and $150-225/vehicle additional cost for window glazing. The annualized cost assumes a 14-year CRF (0.101) resulting in approximately $26 per vehicle. It is expected that 14 million vehicles will be affected by this measure resulting in total annualized capital cost of approximately $360M.

Savings is the result of reduced fuel use. Reduced fuel of about 99 million gallons results in a $366M savings annually

[115] National Renewable Energy Laboratory research study "Reduction in Vehicle Temperatures and Fuel Use from Cabin Ventilation, Solar-Reflective Paint, and a New Solar-Reflective Glazing" (Rugh, J.P *et al*. 2007-01-1194). http://www.nrel.gov/vehiclesandfuels/ancillary_loads/pdfs/40986.pdf

[116] The EMissions FACtors (EMFAC) Model is used by ARB to calculate emission rates and population of motor vehicles. Information is available at: http://www.arb.ca.gov/msei/onroad/latest_version.htm

Measure T-5—Ship Electrification at Ports (Adopted Regulation)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Ship Electrification at Ports—Shore Power (Discrete Early Action)	0.2	0	0	0

Overview

This regulation requires ships meeting certain criteria to turn off (cold iron) auxiliary engines at port (hotelling) and acquire power from shore electrification or use another equally effective means of reducing emissions. This measure is motivated primarily by air toxics pollutant reductions but achieves a GHG benefit primarily by shifting electrical generation from high-emitting onboard engines to sources providing electricity to the grid, such as combined-cycle gas turbines.

Assumptions for GHG Emissions Reduction

Staff calculated the GHG emission reduction as a ratio of the per megawatt-hour emissions from onboard ship auxiliary power to the shore power emission multiplied by the MWh of electricity supplied to the ship. Staff used 690g/KWh (6.9×10^{-7} $MMTCO_2E/MWh$) for auxiliary ship engines. A total estimated 715GWh (715,000MWh) of electricity is used by hotelled ships.[117]

$$6.9 \times 10^{-7} MMTCO_2E / MWh \times 715{,}000 MWh = 0.493 MMTCO_2E$$

$$4.37 \times 10^{-7} MMTCO_2E / MWh \text{ (2020 Line Value)} \times 715{,}000 MWh = 0.312 MMTCO_2E$$

$$0.493 MMTCO_2E - 0.312 MMTCO_2E = 0.18 MMTCO_2E$$

Assumptions for Costs and Savings

The cost and savings associated with this measure are assigned to the diesel risk reduction program and therefore no net cost has been included in the Scoping Plan.

Measure T-6—Goods Movement Efficiency Measures

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Goods Movement Systemwide Efficiency Measures	3.5	TBD	TBD	0

[117] The Initial Statement of Reasons (ISOR) for the Shore Power rule (adopted December 2007) is found at http://www.arb.ca.gov/regact/2007/shorepwr07/tsd.pdf. The ISOR details criteria pollutant and GHG emissions and electricity supplied to hotelled ships.

Overview

This measure targets systemwide efficiency improvements in goods movement to achieve GHG reductions from reduced diesel combustion. Staff is developing strategies to achieve the 3.5 $MMTCO_2E$ target. The 3.5 $MMTCO_2E$ target represents about a 22% reduction from the 2020 projected goods movement inventory.

Assumptions for GHG Emissions Reduction

A target of 3.5 $MMTCO_2E$ is established in the Scoping Plan. For the purposes of this analysis, staff estimates the targeted reduction will result from reduced diesel combustion from efficiency (90%) and electrification of equipment currently fueled by diesel (10%). However, because this measure is expected to provide flexibility to the industry in determining the emission reduction approaches that work best for them, the proportion of emission reductions from efficiency improvements and electrification may be different than estimated here. The reduction target is the net of GHG emissions reductions from reduced diesel use plus the increased emissions from electrification.

Additional assumptions used are as follows:

- All fuel used by engines under measure is diesel fuel
- Diesel fuel density of 7 lbs. per gallon
- Diesel GHG emissions of 10.4 kg CO_2E per gallon diesel fuel

<u>For conversion from diesel engine to grid power</u>

- Grid power emission factor of 437 g CO_2E/kWh
- Average diesel engine brake specific fuel consumption value (BSFC) of 250 grams diesel/kWh for the diesel engines covered. Available BSFC data for a sampling of marine, locomotive, and TRU engines ranged from about 200 to 250 g diesel/kWh. Upper end of range (250 g/kWh) used to account for transient operation with lower fuel consumption (higher BSFC).
- CO_2 emission factor of 790 g/kWh for all engines covered under the measure (estimated using 250 g fuel /kWh BSFC and 10.4 kg CO_2E/gallon)

Calculations:

A. <u>Reduction in fuel consumption that will result in 90% of the total 3.5 MMT CO2 emission reduction</u>:

3.5 $MMTCO_2E$ x 90% = 3.15 $MMTCO_2E$ reduction
3.15 $MMTCO_2E$ x (1x 10^{12} g CO_2)/MMT x kg CO_2/1000 g CO_2 x gall diesel/10.4 kg CO_2
= <u>303 million gallons diesel reduced</u>

B. <u>Increase in grid power (and decrease in diesel consumption) associated with conversion from diesel engine power to grid power that will result in 10% of the 3.5 MMT CO2 emission reduction:</u>

3.5 $MMTCO_2E$ x 10% of reduction = 0.35 $MMTCO_2E$ reduction

0.35 $MMTCO_2E$ reduction = [E kWh x 790 g CO_2/kWh from diesel engines] –
[E kWh 437 g CO_2E/kWh from power plants]

Note: The 0.35 $MMTCO_2E$ emissions reduction is represented in this equation as the difference in CO_2 emissions between diesel engines and the grid when supplying the unknown value for energy E. This assumes that when converting from diesel engines to grid power, the same amount of energy will be provided. Solving for E provides the increase in grid power.

0.35 $MMTCO_2E$ = [353 g CO_2/kWh] x E
E= 0.35 $MMTCO_2E$/353 x 10^{-12} MMT/kWh
E= 991 million kWh = 0.991 million MWh~1 million MWh increase

Diesel fuel reduced = 991 million kWh x 250 g diesel/kWh x lb/454 g x gall/7 lbs = 78 million gallons reduced

C. Total decrease in diesel fuel consumption (galls) and increase in grid power used (MWh):

Overall decrease in diesel fuel consumed: ~380 million gallons
Increase in grid power: ~ 1 million MWh

Assumptions for Costs and Savings

Staff is developing the strategies to achieve reductions from goods movement systemwide energy efficiency. The preliminary assumption is that costs and savings will be approximately equivalent.

Measure T-7—Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Heavy-Duty Vehicle GHG Emission Reduction (Aerodynamic Efficiency)	0.93*	1,616*	2,137*	-521*

*This measure is estimated to result in 6.4 $MMTCO_2E$ nationwide emissions reduction of which 0.93 $MMTCO_2E$ is counted toward the AB32 GHG emissions reduction goal in the Scoping Plan. In the economic modeling, the net annualized cost of this measure incorporates the total cost of the equipment associated with nationwide benefits; savings in the economic model accounts for the nationwide fuel savings that is realized by all affected entities.

Overview

This measure would increase heavy-duty vehicle (long-haul trucks) efficiency by requiring installation of best available technology and/or ARB approved technology to reduce aerodynamic drag and rolling resistance. Board consideration of the Heavy-Duty Vehicle GHG Emission Reduction regulation is scheduled for December 2008.[118]

[118] For more information on this proposed regulation see: http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm

Assumptions for GHG Emissions Reduction

Staff estimates the 2020 GHG reduction is approximately 6.4 $MMTCO_2E$ nationwide of which 0.93 $MMTCO_2E$ (9%) is estimated to occur within California. This reduction is derived from an estimated fuel efficiency improvement of 8% with approximately 1.5% and 6.5% increased efficiency resulting from improvements to the tractor and trailers, respectively. A baseline fuel efficiency of 6 miles per gallon (MPG) is estimated to calculate the benefit from efficiency improvements resulting in an improved mileage of 6.5 MPG (6 MPG x 1.08 = 6.48 MPG). The 2020 California VMT for heavy-heavy duty diesel trucks is being refined as part of the regulation development process. Staff initially estimates that approximately 6.7 billion miles are traveled in California by trucks affected by this measure resulting in a GHG emissions reduction of 0.93 $MMTCO_2E$ in California. The estimated fuel reduction nationwide is approximately 615 million gallons of diesel which results in a GHG emissions reduction of 6.4 $MMTCO_2E$.

$$\frac{6{,}675{,}600{,}000 \text{ miles}}{6 \text{ miles/gallon}} = 1{,}113{,}000{,}000 \text{ gallons} \times 8\% = 89{,}000{,}000 \text{ gallons}$$

$$89{,}000{,}000 \text{ gallons diesel} \times 0.0104 \frac{MMTCO_2E}{\text{million gallons diesel}} = 0.93 MMTCO_2E \text{ in California}$$

$$615{,}000{,}000 \text{ gallons diesel} \times 0.0104 \frac{MMTCO_2E}{\text{million gallons diesel}} = 6.4 MMTCO_2E \text{ Nationwide}$$

Assumptions for Costs and Savings

The incremental costs include for tractors included purchase of tires ($100/tire incremental), and for trailers includes side skirts ($1700), front gap fairing ($800), tires ($100/tire incremental x 8 tires = $800) and installation ($800). An industry-average 2.5 trailers per tractor is used to estimate the total cost. The sum of truck retrofit ($1000) plus trailer retrofit ($4100 x 2.5 = $10,250) is $11,250. Staff used $12,000 as an estimate for calculating total costs.

Cost and Savings Calculation	
2020 discounted capital cost (estimated at $12,000/truck-trailer)	$1,616M
California estimated fuel reduction	89M gallons diesel
Diesel combustion emission factor	10.4 $kgCO_2E$/gallon
California-only GHG emissions reduction	0.93 $MMTCO_2E$
Nationwide estimated fuel reduction	615M gallons diesel
Value of nationwide fuel savings	$2,268M
Operational costs	$131M
Net cost savings (fuel savings-operational costs)	$2,137M
Net annualized cost (cost-savings)	*-$521M

*The estimates here are subject to change during the regulatory process

Savings is the result of reduced fuel combustion and increased operational costs. The estimated 615 million gallons of diesel reduced is multiplied by $3.685/gallon to result in a

nationwide savings of $2,268M. Additional operations costs of approximately $131M result in a net savings of $2,137M and a net annualized cost of -$521M. Staff is working to refine estimates of the cost, savings and GHG emissions reduction as part of the regulation development process.

Measure T-8—Medium- and Heavy-Duty Vehicle Hybridization

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Medium- and Heavy-Duty Vehicle Hybridization	0.5	93	177	-85

Overview

This measure would regulate or incentivize GHG reductions from medium- and heavy-duty vehicles used in vocational applications such as parcel delivery trucks, garbage trucks, utility trucks and transit buses. Hybrid electric technology offers the potential to significantly reduce GHG emissions and improve vehicle efficiency from these vehicles.

Assumptions for GHG Emissions Reduction

Staff estimates the potential 2020 GHG emission reduction from the use of hybrid technology on heavy-duty trucks is 0.5 $MMTCO_2E$. This assumes that all new class 3 to 5 (10,001 to 19,500 pounds GVWR) trucks sold in California beginning in 2015 use hybrid technology. Model year 2015-2020 class 3 to 5 trucks are estimated to represent 20 percent of the same class fleet and 30 percent of the same class VMT in 2020 according to EMFAC2007.

From EMFAC2007	CY 2020 (MY 2015-2020)	CY 2020 (ALL MYs)	Assumptions
Vehicles (10,001 to 19,500 lbs)	53,421	273,739	• Fuel economy improvement: 26% • Base truck fuel economy: ~7 mpg
Daily Vehicle Miles (10,001 to 19,500 lbs)	3,694,200	12,166,000	
GHGs Reduced in 2020	0.5 $MMTCO_2E$	1.7 $MMTCO_2E$	

$$\frac{3{,}694{,}200 \text{ miles/day}}{7 \text{ miles/gallon}} = 527{,}742 \text{ gallons/day} \times 347 \text{ days/year} \times 26\% = 47{,}610{,}383 \text{ gallons}$$ [119]

$$47{,}610{,}000 \text{ gallons diesel} \times 0.0104 \frac{MMTCO_2E}{\text{million gallons diesel}} = 0.5 MMTCO_2E$$

[119] The VMT output for EMFAC2007 is in units of miles/day for weekday mileage. Annual miles are calculated using a factor of 347 to account for reduced weekend and holiday mileage.

Assumptions for Costs and Savings

	Base Diesel Truck	Parcel Hybrid Truck	Assumptions
Cost ($)	$40,000	$70,000	Cost of the base truck is from a truck dealership. Incremental cost is from a hybrid builder: $30,000 (75% above cost of base truck) for pre-production parcel trucks. ($10,000, or 25% above cost of base truck for production volume of 10,000 trucks or more)
Life of the vehicle (years)	10	10	Source: Parcel delivery truck fleet operator
Maintenance Cost	Unknown	Unknown	Being pre-production vehicles, the parcel fleet operator has not realized maintenance savings because of problems in software, transmission, parking brake, etc.
Assumed maintenance costs: ($/mile)	$0.16	$0.20	Hybrid truck maintenance cost is assumed to be about 4% lower than base truck for conventional maintenance, but 10% greater when a one-time battery replacement cost of $5000 to $8000 at 22,000 miles/year is included.

Cost and Savings Calculation	
Number of vehicles 2015-2020	53,421
Per vehicle capital cost	$10,000
Capital cost 2015-2020	$534,210,000
10-year CRF at 5% discount rate 0.1295	0.1295
Capital cost 2020 CRF X capital cost	$69.2M
Operating cost	$0.20/mile
Annual miles	22,000
Operating cost per vehicle	$440/year
Operating cost 2020	$23.5M
Total cost 2020	$92.7M
Total fuel reduced	48 million gallons diesel
2020 diesel cost	$3.685
Savings from reduced fuel use	$177M
Net annualized cost (cost-savings)	-$85M

Measure T-9—High Speed Rail

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
High-Speed Rail	1	0	0	0

Overview

This measure supports implementation of plans to construct and operate a High Speed Rail (HSR) between Northern and Southern California. Development of HSR presents a significant opportunity to reduce GHG emissions by offering more GHG-efficient travel options and alternatives to business as usual.

Assumptions for GHG Emissions Reduction

Staff analysis of estimated net CO_2 emission reductions are based on the HSR operating a Phase 1 system between San Francisco and Anaheim for 2020. Cambridge Systematics forecasts 93.9 million annual passengers (MAP) ridership for the full system in 2030. For planning purposes, staff assumes that in 2020 ridership is 26% of this amount, or approximately 24.5 MAP and that operating the HSR will require 50% of the energy that it will use in 2030.

Staff assumes the ridership will include 17% from air passengers, 76% from motor vehicle passengers, and 7% from conventional rail and induced trips.[120]

- Air passenger displacement from HSR ridership: Air passengers would number about 4.2 MAP with an associated reduction of 0.33 $MMTCO_2E$ based on 350 air miles per passenger trip and 0.5 pounds CO_2 per air passenger mile.
- Motor vehicle passenger displacement from HSR ridership: Motor vehicle passengers would number about 18.7 MAP resulting in CO_2 emission reduction of 1.27 $MMTCO_2E$ based on 250 miles per average motor vehicle trip, 1.5 average occupants per vehicle trip, 22 miles per gallon, and 8.94$kgCO_2E$/gallon of gasoline.
- Riders from other modes would total 1.7 MAP and would displace about 0.04 $MMTCO_2E$, assuming trips in these modes use about 1/3rd the energy per passenger - mile compared to motor vehicle trips.
- The total emissions reduction is the sum of benefits equaling1.65 $MMTCO_2E$ per year (0.33 + 1.28 + 0.04).
- A preliminary estimate of total electric energy to operate the HSR in Phase 1 in 2030 is 2.3 million megawatt-hours per year. Staff estimates the electricity required in 2020 would be about 50% of this amount, or 1.15 million MWh.
- Using the 2020 emission factor of 4.37×10^{-7} $MMTCO_2E$/MWh, the energy to operate the HSR would be about 0.5 $MMTCO_2E$. Thus, the net benefit for the Phase 1 HST would be about 1.15 $MMTCO_2E$ (1.65 – 0.50) in 2020.
- Net reduction for HSR is rounded to 1 $MMTCO_2E$.

[120] http://www.cahighspeedrail.ca.gov/images/chsr/20080128135423_R9a_Report.pdf

Assumptions for Costs and Savings

Costs of the measure are the result of existing state policy direction and therefore are not attributed to the AB 32 GHG emissions reduction program.

Electricity and Natural Gas

General Assumptions

Measures in the Scoping Plan to reduce electricity and natural gas use are developed based on reducing an amount of energy use and calculating the reduction of GHG emission using an emission factor.

For electricity, measures are assumed to replace in-state natural gas electricity generation. This emission factor is 4.37×10^{-7} $MMTCO_2E/MWh$ (963 $lbsCO_2E/MWh$).

For natural gas combustion, the emission factor is 5.3156×10^{-8} $MMTCO_2E/MMBTU$ for Commercial and Residential combustion and 5.3072×10^{-8} $MMTCO_2E/MMBTU$ for Industrial and Electric Power use. All conversion constants are 2020 values.

The calculation of cost and savings rely on $7.94/MMBTU ($0.80/therm) for natural gas, and an average cost of $86.09/MWh for other electricity generation. When appropriate, ARB assumed a 7.8% line loss associated with in-state electricity transmission. The benefits from avoided line loss are pointed out in the specific measures below. Avoided line loss is calculated as:

$$\text{Avoided line loss} = \frac{x}{1-0.078} - x, \text{ where } x \text{ is the reduced grid demand}$$

Measure E-1 and CR-1—Energy Efficiency

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Electricity Energy Efficiency (32,000GWh)	15.2	3,402	5,065	-1,663
Natural Gas Energy Efficiency (800 million therms)	4.3	963	1,433	-470
Measures Evaluated in Economic Modeling as a Surrogate for Cap-and-Trade Program				
Additional Electricity Efficiency (additional 8000GWh)	3.8	1,276	1,266	9.5
Additional Natural Gas Efficiency (additional 200 million therms)	1.1	369	367	2.8

Overview

This measure would reduce GHG emissions by increasing statewide energy efficiency for electricity and natural gas beyond current demand projections.

Assumptions for GHG Emissions Reduction

For measure E-1, a target of 32,000 GWh reduced demand is assumed. The benefit from reduced line loss (2,707 GWh) is also included.

$$32{,}000GWh + 2707GWh = 34{,}707GWh$$

$$34{,}707{,}000MWh \times 4.37 \times 10^{-7} MMT/MWh = 15.2MMTCO_2E$$

For measure CR-1 a target of 800 million therms reduced consumption is assumed.

$$800{,}000{,}000\,therms \times {}^{1\,MMBTU}\!/_{10\,therm} = 80{,}000{,}000\,MMBTU$$

$$80{,}000{,}000MMBTU \times 5.3156 \times 10^{-8} MMTCO_2E/MMBTU = 4.3MMTCO_2E$$

Additional electricity and natural gas efficiency, low-cost options modeled as a surrogate for the cap-and-trade program, of 8,000GWh reduced electrical demand and 200 million therms reduced natural gas consumption staff calculates 3.8 $MMTCO_2E$ and 1.1 $MMTCO_2E$, respectively.

$$8{,}000GWh + 677GWh = 8{,}677GWh$$

$$8{,}677{,}000MWh * 4.37 \times 10^{-7} MMT/MWh = 3.8MMTCO_2E$$

$$200{,}000{,}000\text{ therms} \times {}^{1MMBTU}\!/_{10\text{ therm}} = 20{,}000{,}000MMBTU$$

$$20{,}000{,}000MMBTU \times 5.3156 \times 10^{-8} MMTCO_2E/MMBTU = 1.1MMTCO_2E$$

Assumptions for Costs and Savings

Staff estimated the cost and savings from energy efficiency using the Climate Action Team Updated Macroeconomic Analyses Final Report.[121] Costs (2006$) of $217 per ton and savings of $323 per ton of CO_2E reduced as derived from the CAT report are used to calculate the net annualized cost for both electricity and natural gas efficiency.

The net cost and savings per $MTCO_2E$ are derived from the average cost and savings in the CAT Macroeconomics report for building and appliance standards and IOU efficiency programs. The values in the 2007 CAT report are 2006$ and are updated to 2007$ here by multiplying the 2006$ by a Consumer Product Index of 3.3% (1.033). Staff estimates the cost for additional efficiency under evaluation is 50% greater than the cost for the preliminarily recommended efficiency measures (i.e. $224/MT x 1.5 = $336/MT).

[121] The Climate Action Team Updated Macroeconomic Analysis of Climate Strategies for combined electricity and natural gas energy efficiency is found in Exhibit 11 on page 24 of: http://www.climatechange.ca.gov/events/2007-09-14_workshop/final_report/2007-10-15_MACROECONOMIC_ANALYSIS.PDF.

Measure	GHG Reduction	Cost (at $224/MTCO$_2$E) $Millions	Savings (at $333/MTCO$_2$E) $Millions
E-1	15.2	3,402	5,056
CR-1	4.3	963	1,433
Additional Efficiency (Low Cost Measures Modeled as a Surrogate for the Cap-and-Trade Program			
Measure	**GHG Reduction**	**Cost (at $336/MTCO$_2$E) $Millions**	**Savings (at $333/MTCO$_2$E) $Millions**
+8000GWh	3.8	1,276	1,266
+200M therms	1.1	369	367

*Costs for additional efficiency are assumed at 50% greater than the cost for the recommended measure. Savings for additional efficiency are assumed to be equivalent to the recommended measure.

Energy Efficiency Cost and Savings from the CAT-Macroeconomics Update Final Report					
Reduction Strategy	**GHG Reduction MMTCO$_2$E**	**Cost (2006$)**	**Savings (2006$)**	**Cost per MTCO$_2$E**	**Savings per MTCO$_2$E**
Building Standards	2.14	$255M	$658M	$119.16	$307.48
Appliance Standards	4.48	$509M	$1,489M	$113.62	$332.37
IOU Energy Efficiency Programs	3.66	$987M	$1,186M	$269.67	$324.04
Additional IOU Energy Efficiency programs	5.60	$1,690M	$1,790M	$301.79	$319.64
Total (2006$)	15.88	$3,441M	$5,123M	**$216.69**	**$322.61**
Total (2007$) using CPI of 1.033)	15.88	$3,555M	$5,292M	**$223.84**	**$333.25**

Measure CR-2—Solar Water Heating (AB 1470 goal)

GHG Reduction Measure	Potential 2020 Reductions MMTCO$_2$E	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Solar Water Heating (AB 1470 goal)	0.14	0	0	0

Overview

This measure would reduce natural gas use for commercial and residential water heating by installing 200,000 solar water heaters by 2020 per AB 1470 (Huffman). A reduction in GHG emissions of 0.1 MMTCO$_2$E is calculated. Solar heating is an alternative, zero emission, energy source to heat residential water that works with traditional water heating to replace a

portion of the natural gas that would normally be burned. The proposed measure is estimated replace 26 million therms of residential natural gas use each year.

Assumptions for GHG Emissions Reduction

Each solar water heater is assumed to reduce annual natural gas use by 130 therms[122]. In early years of the program, Staff estimates that 5,000 heaters will be installed annually, increasing up to 10,000, 15,000, 25,000 and finally 50,000 installations each year to meet the total 200,000 installed solar water heaters goal.

$$130 \text{ therms/he ater} \times 200{,}000 \text{ heaters} = 26{,}000{,}000 \text{ therms}$$

$$26{,}000{,}000 \text{ therms} \times {}^{1MMBTU}\!/_{10 \text{ therm}} = 2{,}600{,}000 MMBTU$$

$$2{,}600{,}000 MMBTU \times 5.3156 \times 10^{-8} MMTCO_2E / MMBTU = 0.14 MMTCO_2E$$

Assumptions for Costs and Savings

Costs of the recommended solar water heating measure are the result of existing state policies (AB 1470) and therefore are not attributed to the AB 32 GHG emissions reduction program.

Cost and Savings Calculation	
Cumulative capital cost	$5,636M
Estimated Lifetime	20 years
CRF (20 year amortization and 5% discount rate)	0.080242587
Annualized capital cost in 2020 (CRF x total capital cost)	$452M
Natural gas savings	201.5M therms
Value of natural gas saved in 2020 (@ $0.80/therm)	$160M
Net annualized cost (cost-savings)	$292M

Measure E-2—Increase Combined Heat and Power

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Increase Combined Heat and Power by 30,000 GWh	6.7	362	1,673	-1,311

Overview

This measure would encourage the use of efficient combined heat and power co-generation, targeting an increase in installed generation capacity of 4000MW by 2020.

[122] Personal communication, California Center for Sustainable Energy from implementing the CPUC's pilot project.

Assumptions for GHG Emissions Reduction

For purposes of calculating GHG reductions, Staff estimated the electric generation potential from CHP (of the amount of electricity offset from the grid, based on an assumed 85% capacity factor), the total amount of fuel consumed onsite, and the amount of waste heat generated for useful thermal purposes (which was then used to calculate the amount of fuel not consumed to produce that amount of thermal energy). Staff estimated that 80% of the cogeneration units would be less than 5MW (i.e. small and medium CHP) and 20% greater than 5MW (i.e. large CHP)[123].

The following table details the assumptions for installations, total electricity generation, amount of natural gas used to make both electricity and heat, the amount of reduced natural gas used in the displaced original heat load, and the net fuel consumption.

	Annual Installations (MW)		Total Electricity Saved (GWh)[124]	Annual MMTherms For Electricity & Heat		Annual MMTherms Displaced heating load		Net Fuel Consumption (MMTherms)
Year	<5MW	>5MW		<5MW	>5MW	<5MW	>5MW	
2009	267	67	2,692	219	48	129	22	116
2010	267	67	5,384	437	97	258	44	232
2011	267	67	8,076	656	145	387	65	349
2012	267	67	10,768	875	194	516	87	465
2013	267	67	13,460	1,094	242	645	109	581
2014	267	67	16,152	1,312	291	774	131	697
2015	267	67	18,844	1,531	339	904	153	814
2016	267	67	21,536	1,750	388	1,033	175	930
2017	267	67	24,228	1,968	436	1,162	196	1,046
2018	267	67	26,920	2,187	484	1,291	218	1,162
2019	267	67	29,612	2,406	533	1,420	240	1,279
2020	267	67	32,304	2,624	581	1,549	262	1,395
***Total**	**3,200**	**800**	**32,304**	**2,624**	**581**	**1,549**	**262**	**1,395**
	4,000 MW total			**3,206**		**1,811**		

The net GHG reduction is calculated as the difference between the GHG emissions from the grid displaced electricity (32,304GWh including the avoided line loss) and the GHG emissions from natural gas combusted to produce both heat and power onsite.

Net Natural gas GHG emission increase:

$$139{,}500{,}000 MMBTU \times 5.3072 \times 10^{-8} MMTCO_2E / MMBTU = 7.41 MMTCO_2E$$

[123] California Energy Commission, Draft Consultant Report, Assessment of California CHP Market and Policy Options for Increased Penetration. Prepared by the Electric Power Research Institute. April 2005.
[124] Total electricity saved includes the benefits of avoided line loss.

Grid supplied electricity GHG emission decrease:

$$29{,}784GWh \text{ (produced by CHP units)} + 2{,}520GWh \text{ (Avoided Line Loss)} = 32{,}303GWh$$

$$32{,}304{,}000MWh * 4.37 \times 10^{-7}\, MMT / MWh = 14.1MMTCO_2E$$

Net GHG Reduction:

$$14.1MMTCO_2E - 7.4MMTCO_2E = 6.7MMTCO_2E$$

Assumptions for Costs and Savings

The installed costs for CHP were estimated by averaging costs for several <5MW turbines ($1,300/kW for small CHP) and calculating the cost of one 40MW turbine ($1,750/kW for large CHP)[125].

	Annual Installations (MW)		Annual Installed Costs (millions $)**	
Year	**<5 MW**	**>5 MW**	**<5 MW @ $1,300/kW**	**>5 MW @ $1,750/kW**
2009	267	67	347	117
2010	267	67	347	117
2011	267	67	347	117
2012	267	67	347	117
2013	267	67	347	117
2014	267	67	347	117
2015	267	67	347	117
2016	267	67	347	117
2017	267	67	347	117
2018	267	67	347	117
2019	267	67	347	117
2020	267	67	347	117
*Total	3,200	800	4,164	1,404
	4,000		5,568	

[125] Staff estimated installed costs by evaluating actual equipment pricing (from a manufacturer) averaged for various sizes of gas turbines. Staff then added an assumed installation cost (which is roughly double the equipment cost) to get the total installed cost. ARB consulted with the equipment manufacturer in development of these costs.

Cost Calculation	
Capital cost	$5568M
30-year CRF at 5% discount	0.06505
Annualized capital cost in 2020 based on 30 year life	$362M
Savings Calculation	
Electricity savings 2020	32,304GWh
Value of electricity savings 2020 (@ $86.09/MWh)	$2,781M
Natural gas consumed for CHP 2020	1,395 million therms
Cost of natural gas consumed for CHP 2020 (@ $0.80/therm)	$1,108M
Net energy savings	$1,673
Net annualized cost (cost-savings)	-$1,311

Measure E-3—Renewables Portfolio Standard (33% by 2020)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
33% Renewables Portfolio Standard	21.3	3,672	1,889	1,782

Overview

This measure would increase electricity production from eligible renewable power sources to 33% by 2020. A reduction in GHG emissions results from replacing natural gas fired electricity production with zero GHG emitting renewable sources of power.

Assumptions for GHG Emissions Reduction

The Renewables Portfolio Standard measure would require 33% of RPS-eligible retail electricity sales to be generated from eligible renewable sources. Measures that reduce retails sales of electricity, i.e. efficiency, co-generation, and other distributed generation, are subtracted from the projected demand in 2020 to calculate the amount of generation (in GWh) to meet the 33% renewables standard. The CEC electricity forecast for 2020 projects 308,070 GWh of RPS-eligible retail sales. The recommended measure in the Scoping Plan assumes 32,000 GWh of energy efficiency gains, approximately 30,000 GWh of combined heat and power generation, and approximately 4500 GWh of solar distributed generation. There are additional benefits from reduced line loss associated with these measures, which is assumed to be 7.8% statewide.

$$308{,}070GWh(RS) - 34{,}707GWh(EE) - 32{,}304GWh(CHP) - 4{,}845GWh(Solar) = 236{,}214GWh$$

$$236{,}214GWh \times 0.33(33\%\text{RPS}) = 77{,}951GWh$$

$$77{,}951GWh - 29{,}286GWh(\text{Current RPS}) = 48{,}665\text{GWh}(\text{RPS Target})$$

$$48{,}665{,}000MWh * 4.37 \times 10^{-7}\, MMT / MWh = 21.25MMTCO_2E$$

Where *RS* is 2020 projected retail sales, *EE* is energy efficiency and conservation plus reduced line loss benefits, *CHP* is generation from the combined heat and power measure, and *Solar* is the generation and reduced line loss benefits from the million solar roofs program. Using 4.37×10^{-4} $MMTCO_2E/GWh$ gives an emissions reduction of 21.3 $MMTCO_2E$.

The emissions reduction associated with going from 20% to 33% RPS is necessary for the cost and savings calculation below. Using the approach from above Staff calculates a net GHG emissions reduction for 20-33% RPS of 13.4 $MMTCO_2E$.

$$236{,}214\ GWh \times 0.2(20\%\ RPS) = 47{,}243\ GWh$$

$$47{,}243\ GWh - 29{,}286\ GWh\ (\text{Current RPS}) = 17{,}957\ GWh$$

$$17{,}957{,}000 MWh * 4.37 \times 10^{-7}\ MMT / MWh = 7.84 MMTCO_2E$$

$$21.25 MMTCO_2E - 7.84 MMTCO_2E = 13.4 MMTCO_2E$$

Assumptions for Costs and Savings

Cost and savings assumptions are derived from Energy and Environmental Economics, Inc.'s (E3) modeling of renewables.[126] Staff estimated costs at \$274/ $MTCO_2E$ and savings at \$141/ $MTCO_2E$ based on the E3 modeling work with a net cost of \$133/$MTCO_2E$ for a net GHG reduction going from 20-33% RPS of 13.4 $MMTCO_2E$. Costs for the GHG reduction associated with the existing 20% RPS are the result of existing State policies and therefore are not attributed to the AB 32 GHG emissions reduction program.

$$13.4 MMTCO_2E \times \$274 / MT = \$3{,}672 M$$

$$13.4 MMTCO_2E \times \$141 / MT = \$1{,}889 M$$

Measure E-4—Million Solar Roofs

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost (\$Millions)	Savings (\$Millions)	Net Annualized Cost (\$Millions) [Cost-Savings]
Million Solar Roofs	2.1	0	0	0

Overview

This measure follows the direction of Governor Schwarzenegger's Million Solar Roofs program to install 3000MW of photovoltaic electrical generation in residential and commercial applications by 2017.

[126] Energy and Environmental Economics, Inc. (E3), http://www.ethree.com/GHG/E3_CPUC_GHGResults_13May08%20(2).pdf

Assumptions for GHG Emissions Reduction

Staff used a capacity factor for photovoltaic solar power of 17% in calculating the displaced grid electricity from this measure. The benefit from reduced line loss (a constant 7.8%) is also included.

$$3000MW \times 8760\ hours/year \times 17\% = 4{,}467{,}600MWh/year + 377{,}953MWh(\text{avoided line loss})$$

$$4{,}845{,}553MWh \times 4.37 \times 10^{-7}\ MMT/MWh = 2.1MMTCO_2E$$

Assumptions for Costs and Savings

Costs of the E-4 measure are the result of existing state policies and therefore are not attributed to the AB 32 GHG emissions reduction program.

Industry

Measure I-1: Energy Efficiency and Co-Benefits Audits for Large Industrial Sources

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Energy-Efficiency and Co-Benefits Audits for Large Industrial Sources	TBD	TBD	TBD	TBD

Overview

This measure would require an energy efficiency audit for large stationary GHG emissions sources to identify potential reductions that are cost-effective for GHG, criteria and toxics.

Assumptions for GHG Emissions Reduction

TBD

Assumptions for Costs and Savings

TBD

Measure I-2: Oil and Gas Extraction GHG Emission Reduction

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Oil and Gas Extraction GHG Emission Reduction	0.2	0.4	4.1	-3.7

Overview

This measure would address fugitive GHG emissions from the extraction of California's large oil and gas industry, including on and off-shore sources. Fugitive emissions—mostly methane—account for approximately 5% of the GHG emissions from this part of the sector and are estimated to be 0.3 $MMTCO_2E$. These emissions are from well and process equipment venting; leaks of flanges, valves and other fittings on the well and equipment; and from separation and storage units such as sumps and storage tanks. Controls for the fugitive sources range from applying simple fixes to existing technologies, to deploying new technologies to replace inefficient equipment and to detect leaks.

Assumptions for GHG Emissions Reduction

The reduction of 0.2 $MMTCO_2E$ comes from a limited amount of changing operating practices while taking compressors off-line; installing compressor rod packing systems; replacing high-bleed pneumatics with low-bleed pneumatics; improved leak detection; and installing electronic flare ignition devices. These estimations will be refined as a more robust

emissions inventory is developed via an industry-wide survey and the control approaches of the measure identified.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost	$795,000
Estimated capital lifetime	5 years
5-year Capital Recovery Factor	0.2310
Annualized Capital cost 2020	$183,645
Operating cost in 2020	$217,000
Natural gas reduction	520,000 MMBTU
Value of Natural Gas Savings (@ $7.94/MMBTU)	$4.1M
Total 2020 cost	$400,000
Total 2020 savings	$4.1M
Net annualized cost (cost-savings)	-$3.7M

Measure I-3: GHG Leak Reduction from Oil and Gas Transmission

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
GHG Leak Reduction from Oil and Gas Transmission	0.9	0.5	17.7	-17

Overview

This measure would address fugitive emissions from the transmission and distribution of natural gas throughout California. These emissions come from venting, accidental releases of GHGs, and leaks from flanges, valves, and other fittings, all of which occur along pipelines. This measure would include improving operating practices and replacing older equipment (flanges, valves and fittings).

Assumptions for GHG Emissions Reduction

Changing operating practices while taking compressors off-line achieves almost all of the estimated 0.9 $MMTCO_2E$ emissions reduction. The measure would largely be based on the U.S. EPA's Natural Gas STAR program aimed at cost effective approaches to reducing methane emissions. Staff estimated the fugitive emissions reduction by applying the natural gas savings from the U.S. EPA's Natural Gas STAR program actions to a number of units in the current emissions inventory. These estimations will be refined as a more robust emissions inventory is developed via an industry-wide survey.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost 2015	$24,500
Lifetime	5 years
5-year Capital Recovery Factor	0.2310
Annualized capital cost 2020	$5,660
Operating cost 2020	$502,000
Natural gas reduction	2,230,000 MMBTU
Value of natural gas savings (@ $7.94/MMBTU)	$17.7M
Total 2020 cost	$0.5M
Total 2020 savings	$17.7M
Net annualized cost (cost-savings)	-$17M

Measure I-4: Refinery Flare Recovery Process Improvements

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Refinery Flare Recovery Process Improvements	0.33	6.7	46.1	-39.5

Overview

This measure would reduce GHG emissions from refinery flares by increasing the efficiency of the flare gas recovery process Assumptions for GHG Emissions Reduction.

Measure	Description	Number of Units Affected	Estimated Capital Cost ($million)	Existing Emissions (MMT CO2E)	Emissions Reduction (MMT CO2E)	Percent Emissions Reduction
1.Increase Gas Recovery Capacity at Flares	Install additional compressors in flare systems	Flare systems at 19 refineries	71.3	0.67	0.33	50

Note: This measure entails providing adequate gas recovery capacity and best operating practices (fuel recovery savings)

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost 2020	$71M
Capital life	20 years
20-year CRF (@5% discount rate)	0.08024
Annual cost 2020 (Capital cost x CRF)	$5.71M
2020 operational costs	$0.94M
total annual cost 2020	$6.65M
Natural gas savings	5,800,000 MMBTU
2020 value of fuel savings (@ $7.94/MMBTU)	$46.1M
Total savings	$46.1M
Net annualized cost (cost-savings)	-$39.5M

Measure I-5: Removal of Methane Exemption from Existing Refinery Regulations

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Removal of Methane Exemption from Existing Refinery Regulations	0.014	3.3	2.7	0.57

Overview

This measure would remove the methane exemptions from the regulations applicable to equipment and sources employed in California's refineries.

Assumptions for GHG Emissions Reduction

ARB relied on the analysis performed by South Coast Air Quality Management District (SCAQMD) for the adoption of their Rule 1173, Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants. ARB staff assumed that exempt hydrocarbons, assumed to be methane, could be reduced by a similar 80 percent if the equipment associated with the processing and piping of the methane-rich streams were subject to the leak detection and repair requirements of the rule. Staff also applied this factor to two refineries located in the San Joaquin Valley Unified Air Pollution Control District. The Bay Area Air Quality Management District rule for leak detection and repair already included methane.

Assumptions for Costs and Savings

ARB staff used the cost estimates provided by the SCAQMD analysis for Rule 1173, updated the labor costs, estimated that an additional five percent of valves, compressors, and

connections would be inspected and repaired, and applied these factors to the SCAQMD and SJVAPCD.

Cost and Savings Calculation	
Operational cost in 2020	$3.3M
2020 Savings	$2.7M
Net annualized cost (cost-savings)	$0.57M

Other Industrial Measures Evaluated by ARB

The following measures are included in the economic model runs as potential technical options that have been evaluated by staff as low cost (that is they cost less than the carbon price outlined in Appendix G) for achieving reductions of GHG emissions in the Industrial sector under the cap-and-trade program. These measures, although not part of the recommendation in the AB32 GHG emissions reduction program, were therefore used as a surrogate for the cap-and-trade program in the economic modeling.

Carbon Intensity Standard for Cement Manufacturers

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Carbon Intensity Standard for California Cement Manufacturers	1.9	19.4	22.8	-3.4

Overview

This measure evaluates a standard of 0.8 metric tons of CO_2/metric ton of cement as the average carbon intensity factors (CIF) for cement used in California. This standard would apply to imported cement as well as cement manufactured in California. The CIF is defined as metric tons CO_2 emitted per metric ton of cement produced. CIF improvements at the cement production level are expected to be met through alternative fuels or energy efficiency measures. There is very little addition of supplementary cementious materials (SCMs) that occur at the manufacturing plants today. Therefore, focuses on ensuring that lower carbon cement is produced by maximizing the use of alternative fuels and energy efficiency.

Assumptions for GHG Emissions Reduction

Alternative Fuels

The alternative fuel scenario is calculated based on the ARB inventory. The baseline year is 2004 for the cement production and GHG emissions from manufacturers. Staff assumed a 2% annual increase in cement production and imports are 40% of cement consumed in California. The 2004 statewide baseline numbers are as follows:

- Fuel combustion = 4.06 $MMTCO_2E$
- Calcination = 5.77 $MMTCO_2E$

- Electricity = 0.70 $MMTCO_2E$ (based on California Energy Commission emission factor and the Portland Cement Association external electricity output for 2005)
- Total CO2 emissions for California cement plants = 10.53 $MMTCO_2E$
- Clinker Production = 11.23 MMT (USGS, 2004)
- Cement Production = 11.92 MMT (USGS, 2004)

Based on ARB's analysis of potential alternative fuel options, we believe a 5 percent reduction in greenhouse gas emissions is feasible and cost-effective.

The estimated statewide CIF based on instate cement production is 0.895 metric tons CO_2 per metric ton cement. If the 5% reduction were implemented, the CIF for each one would be 0.855.

Improved Energy Efficiency

The improved energy efficiency is based on fuel and electricity intensity scenarios of 3.0 MBtu per short ton of clinker produced and 109 kWh per ton of cement produced with 2004 and 2005 California cement industry data. Staff estimated an emission reduction of 0.93 $MMTCO_2E$ and a 0.055 $MTCO_2E$/MT of cement reduction in the CIF value. When combining the alternative fuel and improved energy efficiency CIF value, the instate CIF value would decrease to below 0.8 $MTCO_2E$/MT cement.

GHG Calculation	
California Cement Produced	11.92 MMT
Current in-state CIF	0.895
CIF with measure under evaluation	0.8

Taking into consideration the 2% growth rate and a 16-year span from 2004 to 2020, reductions from BAU cement emissions would be:

$$(0.895 - 0.8) \times (11.92MMT) \times (1.02)^{16} = 0.095 \times 11.92MMT \times 1.37 = 1.55MMTCO_2E$$

Assumptions for Costs and Savings

The ARB 2004 baseline shows that cement manufacturers are using over 3.60 MBtu/ton clinker. Staff estimates, through improved energy efficient equipment and using less fuel, that the cement manufacturers would be able to meet a 3.0 MBtu/ton clinker. This number is stated in literature for 4 to 5-stage preheater/precalciner kilns. ARB estimates this will result in an initial capital investment of $220 million dollars with an annual fuel expenditure savings of $22.75 million.

Cost and Savings				
Year	Capital Costs ($millions)	Cost Savings from Energy Efficiency - Electricity ($millions)	Cost Savings from Energy Efficiency – Fuel ($millions)	Cost Increase from Alternative Fuels ($millions)
2012	220	11.66	17.45	11.46
2013		11.89	17.80	11.69
2014		12.13	18.16	11.93
2015		12.37	18.52	12.16
2016		12.62	18.89	12.41
2017		12.87	19.27	12.66
2018		13.13	19.65	12.91
2019		13.39	20.05	13.17
2020		13.66	20.45	13.43

Cost and Savings Calculation

Annualized Capital Expenditure:

$202.4 million*0.0802 = $16.23 million (CA cement manufacturers annualized capital cost)

$16.23 million + $1.35 million (annual operating cost) = $17.58 million (CA cement manufacturer's total annual cost)

$17.58 million*1.10 (10% of $17.58 million is the capital cost for imported cement) = $19.34 million

Annual Fuel Expenditure Savings:

$13.66 million + $20.45 million – $13.43 million = $20.68 million

$20.68 million*1.10 (10% of $20.68 million is the fuel savings for imported cement) = $22.75 million

Net Annual Savings: $3.41 million

Carbon Intensity Standard for Concrete Batch Plants

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Carbon Intensity Standard for Concrete Batch Plants	3.1	0	0	0

Overview

This measure evaluated by ARB would require concrete batch plants to have a lower carbon intensity factor (CIF) for cementitious material than the CIF required at the cement manufacturing facility. The standard would be set at 0.6 metric ton CO_2/metric ton of cementitious material used. The standard at the concrete batch plant could be met either by using cement with very low carbon intensity factors, by adding materials such as SCMs to replace cement in the concrete blend, or using a combination of both approaches.

Assumptions for GHG Emissions Reduction

Concrete batch plants can double the total amount of CO_2 reductions through blending of cement compared to the cement manufacturers. The scenario for the concrete batch plants is to blend SCMs in Portland cement to equal at least 15% or more of blended cement and meet a 0.66 CIF standard by 2012. In 2015, the cement that is used to manufacture concrete must meet a 25% blend of SCMs and comply with a 0.6 CIF standard.

The CIF standard for cement used by concrete batch plants in 2012 through 2014 would comply with 0.66 MT CO_2/MT cement. By 2015, the CIF for cement would be 0.6 $MTCO_2$/MT cementitious material. The calculation for GHG reductions in 2020 is below.

GHG calculation assumptions:

- California Cement Produced: 11.92 MMT
- CIF Factor Under Manufacturer Regulations: 0.8
- CIF Under Batch Plant Regulations: 0.6

Taking into consideration the 2% growth rate and a 16-year span from 2004 to 2020, reductions from BAU cement emissions would be:

$$(0.8-0.6)\times(11.92MMT)\times(1.02)^{16} = 0.2\times 11.92MMT\times 1.37 = 3.27MMTCO_2E$$

Assumptions for Costs and Savings

Currently, the cost of a ton of SCMs is approximately the same as the cost of a ton of cement (about $100/ton). Therefore Staff estimates there is no net cost or savings for this measure.

Waste Reduction in Concrete Use

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Waste Reduction in Concrete Use	1.2	55	83	-28

Overview

This measure evaluated by ARB would set a minimum waste requirement or establish emissions fees on unused returned concrete.

Assumptions for GHG Emissions Reduction

ARB estimates that approximately five to eight percent of the concrete that is made in California each year is returned to the plant as waste. Given cement is the main source of GHG emissions in concrete, a reduction opportunity over 1 $MMTCO_2E$ exists by 2020.

GHG calculation assumptions:

- Total Cement: 11.92 MMT
- Wasted Cement: (0.08)(11.92)= 0.954 MMT
- Current CIF: 0.895 $MTCO_2$/MT cement
- 2% Annual Growth Rate

$$0.08 \times 11.92 MMT \times 1.02^{16} \times 0.895 = 1.17 MMTCO_2E$$

Assumptions for Costs and Savings

ARB assumes $100 as an average cost per ton of concrete and an added operational cost of $70 per ton of wasted concrete to achieve maximum efficiency. This results in a net cost savings of $30/ton of cement and an annual savings of $28 million.

Cost and Savings Calculation	
Wasted Cement	0.954MMT
Net savings per MT concrete ($100-$70=$30)	$30
Annual savings	$28M

Refinery Energy Efficiency Process Improvements

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Refinery Energy Efficiency Process Improvements	3.4	64.5	415	-350

Overview

This measure evaluated by ARB would reduce GHG emissions from refineries by reducing fossil fuels consumption across a variety of refinery processes including process heaters, boilers, fluid catalytic crackers, and hydrogen plants.

Assumptions for GHG Emissions Reduction

Measure	Description	Number of Units Affected	Estimated Capital Cost ($million)	Existing Emissions (MMT CO2E)	Emissions Reduction (MMT CO2E)	Percent Emissions Reduction
1.Improve Efficiency of Boilers and Process Heaters	Improve efficiency of half of total units by 15%	300 of 600	272	14.8	1.0	6.8
2.Install FCC Power Recovery Turbine	Capture mechanical work from FCC regenerator flue gas	3 of 10	21	6.11*	0.47	7.7
3.Improve Catalyst Type at FCC	Reduce carbon buildup on catalyst	4 of 10	11	* included above	0.82	13
4.Modernize Hydrogen Plants	Use pressure swing adsorption technology	Reduce H_2 plant emissions by 20% overall	387	5.8	1.1	19
Totals			**691**	**26.7**	**3.4**	**13**[127]

Notes:

1. Improve efficiency of 300 boilers and process heaters from 73 percent to 88 percent (fuel savings)
2. Valero refinery in Houston uses pressure drop of regenerator gas to drive turbine and recover mechanical power to compress regenerator inlet air, saving 22MW of energy otherwise needed for this compression (assume fuel savings)
3. Less carbon buildup on catalyst means less combustion to remove it (fuel savings)
4. Pressure swing adsorption requires 20 percent less energy than amine systems per cubic foot of hydrogen produced (fuel savings)

[127] Total refinery GHG emissions are estimated at 35.2 MMT CO_2 E. Therefore, overall estimated refinery emissions reductions represent approximately 10 percent of that total.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost 2020	$691M
Capital life	20 years
20-year CRF (@5% discount rate)	0.08024
Annual cost 2020 (Capital cost x CRF)	$55.5M
2020 operational costs	$9M
total annual cost 2020	$64.5M
Natural gas savings	51,800,000 MMBTU
2020 value of fuel savings (@ $7.94/MMBTU)	$406M
Operational savings	$9M
Total savings	$415M
Net annualized cost (cost-savings)	-$350M

Oil and Gas Extraction Combustion Related GHG Emission Reduction

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Oil and Gas Extraction Combustion Related GHG Emission Reduction	1.8	107	274	-167

Overview

This measure evaluated by ARB would address GHG emissions resulting from the extraction of California's large oil and gas industry, including on and off-shore sources. This measure focuses on extraction-related GHG emissions from combustion sources. These emissions are produced mainly from the combustion of natural gas in generators, boilers, pumps and other related equipment. The measure could include: repowering, retrofitting, replacing or repairing existing equipment; installing new combined heat and power; electrifying equipment; and possibly employing CO_2 injection to enhance oil recovery.

Assumptions for GHG Emissions Reduction

Replacement and retrofitting of boilers and steam generators with more efficient ones, as well as replacing internal combustion engine (ICE) pumps with electric motors, achieves an estimated 1.8 $MMTCO_2E$ reduction. These estimations will be refined as a more robust emission inventory is developed via an industry-wide survey and the control approaches of the potential measures are identified.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost	$357M
Estimated capital lifetime	20 years
20-year Capital Recovery Factor	0.08024
Annualized Capital cost 2020	$28.6M
Operating cost in 2020	$23.3M
Non-energy cost savings in 2020	$8.8M
Electricity use	637,000 MWh
Value of electric use in 2020 (@ $86/MWh)	$55M
Natural gas reduction	33,400,000 MMBTU
Value of Natural Gas Savings (@ $7.94/MMBTU)	$265M
Total 2020 cost	$106.9M
Total 2020 savings	$274M
Net annualized cost (cost-savings)	-$167M

GHG Combustion Related Emissions Reduction from Oil and Gas Transmission

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
GHG Combustion Related Emissions Reduction from Oil and Gas Transmission	0.1	14.8	16.3	-1.5

Overview

This measure evaluated by ARB addresses combustion related GHG emissions from the transmission and distribution of natural gas throughout California. This measure would include installing more energy efficient equipment and switching to low carbon fuels to run the equipment.

Assumptions for GHG Emissions Reduction

Replacing just a handful of ICE pumps and compressors with electric motors achieves the entire 0.1 $MMTCO_2E$ emissions reduction. These estimations will be refined as a more robust emission inventory is developed via an industry-wide survey and the control approaches of the potential measure are identified.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Capital cost 2015	$28.4M
Lifetime	20 years
20-year Capital Recovery Factor	0.08024
Annualized capital cost 2020	$2.27M
Electricity cost	139,000 MWh
Value of electricity cost in 2020 (@$86/MWh)	$12M
Natural gas reduction	1,900,000 MMBTU
Value of natural gas savings (@ $7.94/MMBTU)	$15.5M
Operating cost 2020	$0.54M
Non-energy cost savings in 2020	$1.2M
Total 2020 cost	$14.8M
Total 2020 savings	$16.3M
Net annualized cost (cost-savings)	-$1.5

Industrial Boiler Efficiency

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Industrial Boiler Efficiency	1	22.9	150	-127

Overview

This measure evaluated by ARB would require one or more of the following: annual tuning of all boilers, the installation of an oxygen trim system, and/or a non-condensing economizer to maximize boiler efficiency. A source could also replace an existing boiler with a new one that is equipped with these systems.

Assumptions for GHG Emissions Reduction

Assumptions:

- Estimated annual emissions based on draft Greenhouse Gas Inventory Forecast Estimates (February 6, 2008) 2020 projected emissions from natural gas: 24.19 $MMTCO_2E$
- Boiler efficiency measure applies to approximately 80% of the universe due to this natural gas usage
- Boiler Efficiency Measure accomplishes a 5% reduction in GHG emissions

$$(0.80)(24.19\ MMTCO_2E)(0.05) = 1.0\ MMTCO_2E \text{ reduction annually}$$

The Boiler Efficiency Measure requires the efficiency improvements summarized in the table below. Costs were estimated by determining the cost of each requirement and the approximate number of boilers that would need each type of the two retrofits or tuning.

Summary of Measure Requirements	
Applicability	**Requirement**
All permitted boilers	Annual tuning
Boilers rated at or over 10 MMBtu/hr	Retrofit with an oxygen trim system including parallel positioning and VFD
Boilers rated at or over 50 MMBtu/hr	Retrofit with a non-condensing economizer

Assumptions for Costs and Savings

- Total Capital Cost ($90,390,000)
    - The capital cost is derived from the cost of purchasing and installing equipment retrofits required by the measure multiplied by the approximate total number of installations. The total number of installations was estimated using engineering judgment, data from ARB's CEIDARS database, air district databases, and from information supplied by an industry sales representative and representatives of a consulting firm that administers a commercial and industrial boiler efficiency program.
- Annual Tuning requirement
    - Capital cost = $0.
- Retrofit of 10 MMBtu/hr boilers with oxygen trim, parallel positioning, VFD
- Equipment costs for retrofit assuming 600 boilers rated at or over 10 MMBtu/hr with oxygen trim, parallel positioning, and VFD ($96,000 per unit) = $57,600,000
- Note: Assumed 60% (600) of the 1000 boilers in CEIDARS inventory are not already equipped with oxygen trim, parallel positioning, and VFD and need the retrofit.
- Capital costs for retrofit of 105 boilers rated at or over 50 MMBtu/hr with a non-condensing economizer ($200,000 per unit) = $21,000,000
- Assumed 60% (105) of the 175 boilers in the State are not already equipped with a non-condensing economizer and need the retrofit. South Coast database shows there are 70 boilers in the District over 50 MMBtu/hr.
- Assuming South Coast has 40 percent of the inventory in the State, the total number of boilers over 50 MMBtu/hr in California is 70/0.4 = 175 boilers.
- Capital costs: $78,600,000
- Total installation costs (15 percent of capital costs) = $11,790,000
- Total capital and installation costs for boiler retrofits = $90,390,000
- Annual operating cost ($15,610,000)
- Annual maintenance costs for boiler retrofits (assumed to be 10 percent of capital costs) = $7,860,000
- Annual tuning costs for 3100 boilers ($2500 per unit) = $7,750,000
- Note: all the costs for the tuning requirement are considered to be an annual maintenance cost. The 2004 CEIDARS NO_x inventory showed approximately 3100 permitted natural gas boilers.
- Total annual operating costs (annual maintenance costs and annual tuning costs) = $15,610,000
- Lifetime Expenditures 2016 through 2020 ($168,440,000)
- $90,390,000 + (5 years)($15,610,000) = $168,440,000
- Cost Savings ($149,640,000)

- (There will also be an unknown electricity savings from the VFD.)
  - 1 $MMTCO_2E$)(10^6 metric ton/MMT)/(0.05306 metric tons CO_2/MMBtu) = 18,846,588 MMBtu natural gas annual savings
- Annual fuel cost savings ($7.94/MMBtu)(18,846,588 MMBtu) = $149,641,908
- Lifetime Cost Savings 2016 through 2020
- (5 years)($149,641,908) = $748,209,543

Summary Cost and Savings Calculation	
Total capital cost	$90.4M
Operating cost 2020	$15.6M
Estimated capital life	20 years
20-year CRF	0.08024
Annualized capital cost (capital x CRF)	$7.25M
Total cost in 2020	$22.86M
Natural gas savings	18,846,588 MMBTU
Value of Natural Gas Savings in 2020 (@ $7.94/MMBTU)	$149.7M
Net annualized cost (cost-savings)	-$127M

Stationary Internal Combustion Engine Electrification

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Stationary Internal Combustion Engine Electrification	0.3	17.9	25	-7.1

Overview

This measure evaluated by ARB would affect owners and operators of engines in industrial and commercial operations rates at over 50 hp and used as primary power sources ("prime" engines). This evaluated measure would not affect internal combustion (IC) engines used for emergency power generation. This evaluated measure would include the replacement of IC engines with electric motors (electrification).

Assumptions for GHG Emissions Reduction

In the Draft Scoping Plan ARB estimated the GHG emission reduction potential as approximately 0.1 to 1.0 $MMTCO_2E$. As ARB continued to evaluate this measure, it became apparent the high end of the range – 1 MMT, was unrealistic. Such a large reduction would require electrifying over two-thirds of the engines in this category by 2020. This level is not achievable due to both logistical difficulties (access to electrical service and/or required duty cycles) and high cost for engines that are not operated a high percentage of the time. To reflect this, ARB believes a more realistic range of potential reductions is 0.1 to 0.5. A targeted reduction of 0.3 $MMTCO_2E$ was evaluated as technologically feasible for the purposes of modeling surrogate reduction measures for the cap-and-trade program.

Assumptions for Costs and Savings

Cost and Savings Calculation	
Total capital cost	$50.7M
Operating cost 2020	$14M
Estimated capital life	20 years
20-year CRF (@ 5% discount rate)	0.8024
Annualized capital cost (capital x CRF)	$4.1M
Total 2020 cost	$17.9M
Natural Gas Savings	7,670,600 MMBTU
Value of Natural Gas Savings in 2020 (@ $7.94/MMBTU	60.9M
Diesel Savings in 2020	11.4 million gallons
Value of Diesel Savings 2020 (@ $3.685/gallon)	$41.9M
Increased electricity use in 2020	904,443 MWh
Cost of increased electricity (@ $86/MWh)	$77.9M
Net savings in fuel	25.04
Net annualized cost (cost-savings)	-$13M

Recycling and Waste

Measure RW-1: Landfill Methane Control

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Landfill Methane Control (Discrete Early Action)	1	52	0	52

Overview

This measure would reduce methane emissions from municipal solid waste landfills by requiring owners and operators to install gas collection and control systems at smaller and other uncontrolled landfills. Additionally, all affected landfills will be required to satisfy enhanced methane monitoring requirements to ensure that their gas collection and control system is operating optimally and that fugitive emissions are minimized.

Assumptions for GHG Emissions Reduction

Staff estimates 0.8 $MMTCO_2E$ GHG emissions reduction from the approximately 53 landfills having greater than 450,000 tons of waste-in-place that may generate sufficient gas to support the installation of a gas collection and control system with a flare. Staff estimated an additional 0.2 $MMTCO_2E$ GHG emissions reduction from enhanced monitoring requirements to ensure that the landfill's gas collection and control system is operating optimally and that fugitive emissions are minimized. The total estimated reduction is 0.8+0.2 = 1 $MMTCO_2E$.

Assumptions for Costs and Savings

Staff estimated a capital cost of $3,438,000 and annual operating cost of $706,397 for each of the aforementioned 53 facilities. The lifetime of the gas collection and control systems is estimated at 15 years. The total estimated cost is approximately $1M per facility in 2020. Total industry costs, included those for landfills with existing gas collection and control systems, will be estimated in the staff report for the landfill methane control measure. The costs and emission reduction estimates presented here are preliminary estimates.

Cost Calculation	
Per facility capital cost (53 facilities total)	$3,438,000
CRF for 20 year expected capital life	0.08024
Annualized capital cost (capital cost x CRF)	$275,874
2020 Operating cost per facility	$706,397
Total per facility cost (annualized capital cost + operating cost)	$982,271
Total net annualized cost (53 facilities x per facility cost)-Assumes no savings	$52M

High Global Warming Potential

Measure H-1: Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing (Discrete Early Action)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Small Containers of Refrigerant	0.26	3	0	3

Overview

This measure reduces GHG emissions from the non-professional servicing of motor vehicle air conditioning systems by do-it-yourself individuals. The original option considered by the Board would restrict the sale and import of the small cans of refrigerant and allow only professional servicing of MVACs. However, additional research and analysis by staff indicates that this approach has the potential for significant cost impact to the consumer. An alternative and superior approach has been identified. Staff's recommendation focuses on reducing primarily the emissions from the can heel. This proposal would include: 1) the installation of a self-sealing dispensing valve on all small containers of refrigerant, 2) the implementation of a mandatory container recycling and refrigerant recovery program, 3) improved labeling on all containers, and 4) the implementation of a consumer education program.

Since this measure is a Discrete Early Action, the proposed regulation would become enforceable on January 1, 2010. The table above includes two rows, corresponding to the two proposals that were considered by Staff. The Scoping Plan Appendix C includes only the estimates associated with the Staff recommended mitigation proposal. The numbers above are refinements based on the most recent information emerging from the public process.

Assumptions for GHG Emissions Reduction

The recommended proposal is estimated to achieve a reduction of approximately 0.26 $MMTCO_2E$ in 2020 resulting from the recovery of the unused refrigerant in the containers and an increased consumer awareness of an optimum charging techniques arising from the improved labeling and the education program.

Assumptions for Costs and Savings

Industry has estimated that the installation of self-sealing valves and the implementation of the recycling program would result in a cost increase of one dollar per container. At 1.8 million cans per year, the increased consumer cost is $1.8 million. Assuming a 95% can return rate and a $10 deposit per can, the 5% of unclaimed deposits amounts to $0.9 million per year and will be an additional cost to the consumers. Total increased cost to the consumer is thus ~$3 million per year.

Measure H-2: SF_6 Limits in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
SF6 Liming in Non-Utility and Non-Semiconductor Applications (Discrete Early Action)	0.3	0.22	0.14	<0.1

Overview

This measure reduces sulfur hexafluoride emissions from non-utility and non-semiconductor-related applications. This includes, but is not limited to, magnesium casting, tracer gas uses, and recreational uses such as magic tricks.

Assumptions for GHG Emissions Reduction

ARB estimated a range of estimates for other uses (non-semiconductor, non-utility, and non-magnesium) is 0.13 – 0.34 (ARB 2008). Alternatives are available and a phase-out is possible for magnesium casting, tracer uses, and recreational uses. A reduction is not possible for medical uses. Alternatives are 98+ percent effective for magnesium casting and range from 50-90+ percent for tracer uses (EPA 2006). Recreational uses would either be eliminated or alternatives would have a near 100% reduction (ARB 2008). Based on alternative effectiveness, reductions from magnesium would be 0.1 $MMTCO_2E$. For other applications, an effectiveness of 90% was used to estimate reductions up to 0.2 $MMTCO_2E$. In total, reductions are estimated at 0.3 $MMTCO_2E$.

Assumptions for Costs and Savings

Due to a lack of data for other sectors, ARB was only able to calculate costs for the magnesium sector. The estimate will still be reasonable since alternatives to sulfur hexafluoride are generally either less expensive per pound or per use (less alternative needed per use) and other uses in this measure do not have capital costs since they do not require significant infrastructure changes.

For the magnesium sector, there are two sets of costs associated with alternate gases: upfront and annual costs. Based on Canadian data, upfront costs could run up to $573,000, which is annualized to approximately $94,000 after conversion to 2007 dollars and annualized using a 10 year lifetime (Environment Canada, 1998). The annual costs, based on the same Canadian study, are approximately $126,000 for training.

There could be an associated cost savings since one alternative is less expensive than sulfur hexafluoride. Based on U.S. EPA, the cost savings will be $140,000 in 2007 dollars.

If a change is made in the manufacturing process for certain industries, the caster must go through a requalification process. These costs are not currently included in the analysis but could be significant.

Measure H-3: Reduction of Perfluorocarbons in Semiconductor Manufacturing (Discrete Early Action)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
High GWP Reduction in Semiconductor Manufacturing (Discrete Early Action)	0.15	2.6	0	2.6

Overview

This measure targets a reduction in emissions of several high global warming potential gases uses in the semiconductor manufacturing industry. Reductions are expected from process optimization, alternative chemistries and abatement technologies. This measure is currently in the regulatory process.

Assumptions for GHG Emissions Reduction

The proposed measure is designed to achieve at least a 50% reduction in emissions of high GWP gases from the semiconductor manufacturing industry. ARB recently conducted an industry survey of GHG emissions from more than 100 semiconductor and related devices facilities. This bottom-up accounting revealed approximately 0.3 $MMTCO_2E$ of emissions in 2006. Staff is proposing to target an emissions reduction of 0.15.

Assumptions for Costs and Savings

The cost of the proposed measure is based on the assumption that abatement technologies are used for compliance. The $2.6 million total annualized cost estimate ($3.3 million in 2007 dollars) was derived from a June 2001 U.S. EPA report[128]. This value included the capital, operating and maintenance costs as a single figure for etch abatement systems. The annualized cost is calculated assuming $23.4 million in capital costs, a 5% discount rate, and a 9 year life for the abatement systems.

[128]U.S. EPA June 2001, U.S. High Global Warming Potential (High GWP) Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions, Chapter 6 Cost and Emission Reduction Analysis of PFC, HFC, and SF_6 Emissions from the Semiconductor Manufacturing in the United States, pg. 6-6, June 2001.

Measure H-4: Limit High GWP Use in Consumer Products (Discrete Early Action)

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Limit High GWP Use in Consumer Products (Discrete Early Action)	0.25	0.06	0	0.06

Overview

The objective of this measure is to reduce the use of high GWP compounds in consumer products when alternatives are available. To achieve these reductions, consumer product formulations would need to be changed to reduce or eliminate the use of high GWP compounds.

Assumptions for GHG Emissions Reduction

The potential reductions for this measure for 2020 were estimated based on the perceived opportunities for reductions of GHG emissions from specific categories of Consumer Products. Emissions of GHG from the specific Consumer Products were determined from formal surveys of manufacturer's sales and formulation data that were conducted for the 2001, 2003 and 2006 sales years. Further, in June 2008, the Board approved a measure to reduce the GHG emissions from Pressurized Gas Dusters. This measure achieved approximately 0.23 $MMTCO_2E$ in 2020. It is anticipated that the remainder of the emission reduction goal could be achieved by adopting GHG standards for other categories of Consumer Products in future rulemakings.

Assumptions for Costs and Savings

The estimated costs attributed to this measure were based on previous consumer products regulations affecting similar categories of products from which emission reductions were anticipated to occur. Specifically, for the Pressurized Gas Dusters, it was estimated that the total costs of the regulation will be approximately $450,000 over ten years or $45,000 a year.[129] Additional costs to manufacturers and consumers will likely occur for additional categories that are regulated for GHG emissions. No savings is assumed.

[129]See "Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation, May 9, 2008. http://www.arb.ca.gov/regact/2008/cp2008/cp2008.htm.

Measure H-5: High GWP Reductions from Mobile Sources

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems	2.5	20.86	0	16
Air Conditioner Refrigerant Leak Test During Vehicle Smog Check	0.5		TBD	TBD
Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers	0.2		TBD	TBD
Enforcement of Federal Ban on Refrigerant Release During Servicing or Dismantling of Motor Vehicle Air Conditioning Systems	0.1		TBD	TBD

Low GWP Refrigerants for New Motor Vehicle Air Conditioning Systems

Overview

This measure would reduce greenhouse gas emissions by replacing high GWP refrigerants used in California's MVACs with lower GWP alternatives that also represent better lifecycle climate performance than the current refrigerant. This measure is meant to initially cover those classes of vehicles not included in the AB 1493 (Pavley) regulation: heavy duty and off-road vehicles. The principal benefit of this measure is the reduction of the GWP impact of refrigerant releases through direct and indirect emissions.

Assumptions for GHG Emissions Reduction

An estimate of the statewide emission inventory is under development for MVAC refrigerants in 2020. Anticipated reductions for 2020 are expected to be 0.7 $MMTCO_2E$ for light duty vehicles and 1.8 $MMTCO_2E$ for heavy duty vehicles for a total of 2.5 $MMTCO_2E$ for a universal phase out of HFC-134a in new and in-use MVACs in California. These projections were based on the current estimated annual leakage rate of R-134a for light duty vehicles and heavy duty trucks. These estimations will be refined as a more robust emission inventory is developed and the likely replacement refrigerants are selected and the split in the market is predicted.

Assumptions for Costs and Savings

Only capital costs were considered in this cost estimate. Additional staff analysis is needed to determine operating costs, cost savings, and economic impacts. The life of potentially new air conditioning systems is expected to be the same as current systems. Capital costs for

the introduction of new refrigerants in the California fleet were estimated to be on the order of $150 million by 2020 based on assumptions that changes begin to phase in around 2013. This estimate is based on a European incremental cost per vehicle of $23 to $28 (at an average exchange rate for the following mentioned year) per LDV in 2003 with a six percent annual increase in cost. The estimate includes several vehicle categories: light duty vehicles, heavy duty vehicles, and off-road vehicles. Actual costs for maintenance will vary depending on the low GWP refrigerant selected. Significant additional analysis is needed to enable and improve cost and performance estimates of the various alternative technologies.

Air Conditioner Refrigerant Leak Test during Vehicle Smog Check

Overview

As originally conceived, the proposed measure may add a refrigerant leak check to the "pass" criteria for the California vehicular inspection and maintenance (I/M) program, Smog Check, for all vehicles that undergo the test. However, additional staff analysis indicates new issues associated with the technical feasibility of the measure that were not originally considered. Thus, further technical assessment is needed. If put in place, all vehicles that pass Smog Check would have motor vehicle air conditioning (MVAC) systems that either leak at or below natural leak rates (to be determined in the measure) or are empty and precluded from further use unless the identified excessive leak is repaired. Inspections of MVACs would be conducted by the Smog Check technician with a portable refrigerant "sniffer" that detects HFC leakage or other means to be determined in the measure. Protocols would be developed for the test, including use of equipment and identification of threshold values to establish repair criteria.

Assumptions for GHG Emissions Reduction

The potential for annual reductions are thus estimated to be from 0.95 $MMTCO_2E$/year as a standalone measure, to 0.48 $MMTCO_2E$/year when considered as an addition to other measures. The estimates are preliminary; realistic values could range from one half to twice the estimates provided. The estimates are based on the following:

- The program would begin in 2011
- All vehicles will use HFC-134a (GWP=1300) in 2011.

Annual sales of R-134a refrigerant in California are assumed to be emitted into the atmosphere annually due to service losses and due to leaking vehicles. These sales are approximately 1.9 $MMTCO_2E$ per year.

To determine order of magnitude estimates, it assumed that implementation of an MVAC test and repair requirement would reduce leaks and service losses by 50% to an annual leak rate of 0.95 $MMTCO_2E$/ year. (More detailed analyses of the potential reductions are currently underway).

Refrigerant entering the state as OEM charge is not included in the emission rate; and refrigerant captured at end of life is not subtracted from the emission rate. (More detailed analyses of the potential reductions are currently underway).

Reductions obtained by implementation of this measure might overlap with reductions obtained by other MVAC related measures. To determine order of magnitude estimates, it is assumed that 50% of the MVAC direct emissions will already have been mitigated by other measures, reducing the potential reduction from 0.95 $MMTCO_2E$/year to 0.48 $MMTCO_2E$/year. (More detailed analyses of the potential reductions are currently underway).

Assumptions for Costs and Savings

Each Smog Check station would have to spend about $200~$300 for each hand-held HFC detector. This assumes the hand-held detector approach proves to be the correct approach. Station owners or technicians would have to pay up to $280 per person to train the Smog Check technicians. The initial cost to Smog Check station owners and technicians would be $2M (Instrument costs) + $4M (Training costs) = $6M. These are one time start up costs. Continuing annual costs are not considered because they are assumed to be covered by increases in the consumer price of a smog check.

Due to the increased time required by technicians to test MVAC systems, the consumer price of a Smog Check is expected to increase by an amount that has yet to be determined.

Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers

Overview

The purpose of this measure is to mitigate any impacts from releases, either intended or accidental, of refrigerant from decommissioned refrigerated shipping containers. Refrigerated shipping containers may accumulate in major ports and that the refrigeration systems on these containers may leak high-GWP refrigerants such as HFC-134a. In particular, the refrigerant remaining in the decommissioned containers, the leakage from these containers and refrigerant disposal as the containers approach end-of-life (EOL).

Assumptions for GHG Emissions Reduction

It is essential that a needs assessment be performed to get an accurate estimate the annual amount of refrigerants that are available for recovery from decommissioned refrigerated shipping containers. It has been estimated that shipping container activity could double by 2020. If it is assumed that this applies to the decommissioned refrigerated shipping containers as well, then the bank becomes 160,000 to 320,000 $MTCO_2E$ based on staff analysis. This estimate represents the upper bound for the possible reduction potential of this mitigation.

Assumptions for Costs and Savings

Very little information on costs and economic impacts is known today about this proposed measure. As part of measure development, an assessment will be performed in order to get a better understanding of the number of refrigerated shipping containers decommissioned each year, the amount of refrigerant remaining, whether there is refrigerant recovery, and the costs associated with the recovery and recycling processes for the remaining refrigerant.

Enforcement of Federal Ban on Refrigerant Release during Servicing or Dismantling of Motor Vehicle Air Conditioning Systems

Overview

An existing federal regulation (40 CFR 82.154) bans the release to the atmosphere of high-GWP refrigerant substance at the end-of-life or during equipment servicing. The current degree of compliance with 40 CFR 82.154 is poorly documented but under review. The goal of this non-regulatory strategy is improved compliance with this regulation prohibiting the venting of certain types of refrigerant, including HFCs, to the atmosphere when MVACs equipment is serviced or dismantled. Venting is avoided by recovering refrigerants with specialized equipment before dismantling or servicing. The recovered refrigerant can be re-used by the owner or transferred to re-processors approved by U.S. EPA for proper disposal.

Assumptions for GHG Emissions Reduction

Reductions from dismantling operations could be expressed as a baseline emission rate times the fraction that is practically recoverable times a goal for fraction of vehicle dismantlers who would be prompted to comply with the federal regulation. None of these values is well known at present.

A rough approximation of the potential reductions from dismantling (as presented in the March 2006 Climate Action Team Report and usable until a better alternative is developed) is 0.1 to 0.6 $MMTCO_2E$ per year in 2010 (assuming the program will be in effect then) and 0.07 to 0.3 $MMTCO_2E$ per year in 2020.

Assumptions for Costs and Savings

Some dismantlers may not have the latest compliant hardware for recovering refrigerants or any equipment at all. Each dismantler who must purchase the equipment would have to spend approximately $3000 to $5000 per unit. The number of units needed would depend on the size of the operation (vehicle throughput). However, this would be an expense that the dismantler has so far avoided only through failure to comply with the existing federal regulation. Thus, this is not a cost burden associated with the proposed strategy.

The same statements apply to obtaining certification for technicians who use the recovery equipment, but with minimal anticipated costs. Training for the U.S. EPA's certification program is offered by various commercial schools. In addition, the Mobile Air Conditioning Society offers free training (a downloadable pamphlet) and a nominal exam fee, so the expense for operator certification should be minimal.

There are costs for storage of recovered refrigerant, record-keeping, and the operators' labor. Again, however, these are expenses already obliged by the federal regulation.

Recovered HFC may have some salvage value, but it is slight.

Measure H-6: High GWP Reduction from Stationary Sources

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
High GWP Refrigerant Tracking/Reporting/ Repair/Deposit Program	6.3	1.0	3.6	-2.6
Specifications for Commercial and Industrial Refrigeration	4.0	1.24	0.66	1
Foam Recovery and Destruction Program	0.3	9	0	9
SF_6 Leak Reduction and Recycling in Electrical Applications	0.1	0.3	0.4	-0.1
Alternative Suppressants in Fire Protection Systems	0.1	2	0.2	2
Residential Refrigeration Early Retirement Program	0.1	18.9	24.8	-6

Stationary Equipment Refrigerant Management Program

The high-GWP Stationary Equipment Refrigerant Management Program integrates two AB 32 early action measures: High-GWP Recycling and Deposit Program and Specifications for New Commercial and Industrial Refrigeration Systems. These two measures, discussed below, target different areas of the refrigerant value chain for stationary equipment. The Stationary Equipment Refrigerant Management Program approaches the challenge of high-GWP gases management in a more holistic manner integrating all sectors of the value chain.

High GWP Refrigerant Tracking, Reporting, Repair, Deposit, and Recovery

Overview

The goal of this measure is to reduce leaks of high-GWP refrigerants from stationary refrigeration and air-conditioning systems and improve service practices that maximize reclamation and recycling of refrigerant. The proposed regulatory action would include facility registration; refrigerant leak detection, monitoring, reporting, and recordkeeping; refrigerant distributor, wholesaler, and reclaimer reporting and recordkeeping; refrigerant sales restrictions to only certified technicians; and a refrigerant cylinder deposit program.

Assumptions for GHG Emissions Reduction

Business as usual emissions are based on the U.S. EPA Vintaging Model adjusted to the California population, as provided below:

Business As Usual	Non-Kyoto	Kyoto	Total
Statewide annual emission estimate: 2004	18	5.3	23.3
Statewide annual emission estimate: 2020	15.3	6.6	21.9

The determination of potential GHG emission reductions from business as usual is based on a year-by-year estimate of 1) compliance rates for leak repair and monitoring, and 2) system retrofitting or retirement. Because the refrigeration and air-conditioning industries are already regulated for ozone depleting substances (ODS), the compliance rates are assumed to be higher for these refrigerants. The range of assumptions for the compliance rates with monitoring, leak repair, and system retrofit and replacement are as follows:

- ODS compliance rates begin at 10% and increase from 5% to 15% each year to reach 100% in 2020.
- HFC compliance rates begin at 5% and increase from 5% to 20% each year to reach 100% in 2020.

The replacement rate for ODS systems is high due to the phase-out of use of ODS as a result of the Montreal Protocol.

The incremental annual emission reduction would be the estimated BAU emissions multiplied by an incremental compliance rate. Take HFC as an example, the incremental annual emission reduction in 2011 is:

5.3 $MMTCO_2E$ x 5% = 0.26 $MMTCO_2E$

The incremental annual emission reduction in 2012 is also:

5.3 $MMTCO_2E$ x 5% = 0.26 $MMTCO_2E$

The total emission reduction for 2012 would be:
0.26 $MMTCO_2E$ + 0.26 $MMTCO_2E$ = 0.52 $MMTCO_2E$
The total emission reduction for 2019 would equal the sum of the incremental annual emission reductions for years 2011 through 2019 = 5.0 $MMTCO_2E$

The incremental annual emission reduction in 2020 based on the 2020 BAU emissions is:
6.6 $MMTCO_2E$ x 20% = 1.3 $MMTCO_2E$

The total emission reduction for 2020 would be:

Total 2019 emission reductions of 5.0 $MMTCO_2E$ + 1.3 $MMTCO_2E$ =
6.3 $MMTCO_2E$

Assumptions for Costs and Savings

Labor and capital costs for monitoring and leak repair and equipment replacement vary for air-conditioning versus refrigeration equipment.

The assumptions for cost and cost savings are as follows:

Monitoring Costs	Cost per Year / Installation
General Cost for Monitoring	$100
Monitoring Equipment	$2,500

Leak Repair Costs		
	Air Conditioning	**Refrigeration**
Labor	$2,000	$3,000
Parts & Refrigerants	$500	$8,000
Replacement	$20,000	$500,000

Facility Inventory		
	Air Conditioning	**Refrigeration**
Total Number of Systems	86,000	10,000
Assumes 10,000 facilities have both air condition and refrigeration.		

Specifications for Commercial and Industrial Refrigeration

Overview

The primary analysis to estimate possible direct emissions reductions was to assume new refrigeration systems installed would use secondary loop refrigeration technology, or technologies that meet the same performance standards as secondary loop technology. Additionally, ARMINES' also reviewed the energy savings impact of technical options being applied in all installations, e.g., floating head pressure controls and closed display cases.

Assumptions for GHG Emissions Reduction

Although commercial and industrial refrigeration inventory research remains in progress, ARB's refrigeration and air-conditioning (RAC) contractor, ARMINES', preliminary work (available at: http://www.arb.ca.gov/cc/commref/armines_report_03_625.pdf) suggests that the Total Equivalent Warming Impact (TEWI) of current direct expansion refrigeration systems commonly used is 0.0307 $MMTCO_2E$ (approximately two to three times that of a secondary loop system).

Based on literature review it is assumed that 250 new commercial refrigeration systems will be installed in California in the 2012 through 2020 time period – approximately 30 per year from 2012 to 2016 and then 25 from 2017 to 2020. The potential emissions from these new stores are estimated as:

Direct Expansion (BAU) = 250 stores * 0.0307 = 7.7 $MMTCO_2E$
Secondary Loop (Low Range) = 250 stores * 0.0085 = 2.1 $MMTCO_2E$
Secondary Loop (High Range) = 250 stores * 0.0126 = 3.1 $MMTCO_2E$

The range of potential emissions reductions are determined based on the difference between the total BAU emissions and the secondary loop systems, or similar technology, emissions – or 2.6 to 5.2 $MMTCO_2E$. This range is averaged and rounded resulting in the potential GHG emission reductions of 4.0 $MMTCO_2E$.

In addition to installation of secondary loop systems, ARMINES' also reviewed the energy savings impact of technical options being applied in installations of all commercial refrigeration equipment within a supermarket, e.g., floating head pressure controls and closed

display cases. The preliminary estimation of energy savings is 1.6 TWh per year (1,600 GWh per year) or 30% below baseline. This energy savings impact is a component of the 4.0 $MMTCO_2E$ discussed above.

Assumptions for Costs and Savings

Based on literature review and discussions with industry stakeholders, the following assumptions were made:

The installation costs increase for a secondary loop refrigeration system is 15-20%, or around $100,000, above current DX systems. Increased costs are due to contractor unfamiliarity with new technologies; installation costs are anticipated to reduce to equal installation costs of direct expansion systems after 2016.

Operation and maintenance costs for a secondary loop refrigeration system are up to 40% lower than direct expansions systems (annual cost savings of approximately $25,400).

Final Cost Estimates are determined as follows:
Total Capital Cost per Year = 30 stores * $100,000 = $3,000,000
Total Cost Savings per Year = 30 stores * $25,400 = $762,000 (2012 to 2016)
Total Cost Savings per Year = 25 stores * $25,400 = $635,000 (2017 to 2020)

Foam Recovery and Destruction Program

Overview

Plastic insulating foams containing high-GWP blowing agents are used in refrigerators, freezers, building insulation, transport refrigerated units, and miscellaneous sources. When the product or material has reached the end of its useful life, the insulating foam emits high-GWP GHGs after it is shredded or broken during recycling, or disposed of in landfills. The goal of the measure is to reduce these end-of-life emissions to as close to zero as possible, by recovering waste foam prior to disposal and landfilling, and destroying the high GWP GHGs within the foam.

Assumptions for GHG Emissions Reduction

Staff estimates for GHG reductions apply a best-case scenario that virtually all potential GHG emissions from waste insulating foam can be reduced at end-of-life by recovering waste foam and destroying the GHGs within the foam before it is recycled or landfilled. Based on literature review and discussions with industry stakeholders, the following assumptions were made:

Based on the U.S. EPA Vintaging Model estimates, the estimated annual emissions in the U.S. in 2006 from insulating foam were 71.4 $MMTCO_2E$, with 2.6 $MMTCO_2E$ from HFC, and the remaining from ODS.

Estimated based on the percent of U.S. population residing in California, HFC emissions in California from foams are estimated as 0.3 $MMTCO_2E$ in 2006.
2.6 $MMTCO_2E$ * 12.2% = 0.3 $MMTCO_2E$

The amount of HFC-containing waste foam has increased about 9 percent per year. By 2020, the estimated emissions of HFCs from waste foam in California will be approximately 1 $MMTCO_2E$ annually.

$0.3\ MMTCO_2E * (1 + 9\%)^{14} = 1.1\ MMTCO_2E$

Of this total, 0.3 $MMTCO_2E$ are expected to be reduced through recovery of appliance foam.

Assumptions for Costs and Savings

Cost estimates are preliminary and will be known with greater precision by July 2010 when an ARB research study will be completed for lifecycle analysis cost of recovery and destruction of high-GWP GHGs.

Costs to recover and destroy foam from appliances are about \$30/$MTCO_2E$ using an automated system. The annual cost of an appliance foam recovery and destruction program to reduce 0.3 $MMTCO_2E$ would be about \$9M per year, assuming all appliances were recycled using an automated system.

SF_6 Leak Reduction and Recycling in Electrical Applications

Overview

This measure will reduce emissions of SF_6 within the electric utility sector and at particle accelerators by requiring the use of best achievable control technology for the detection and repair of leaks, and by the recycling of SF_6.

Assumptions for GHG Emissions Reduction

Staff estimates an annual emission reduction of 0.07 $MMTCO_2E$ calculated from a U.S. EPA reduction estimate of 20% for leak detection and repair and 10% for recycling and recovery based on 2020 projected emissions of 0.22 $MMTCO_2E$ in California.

Assumptions for Costs and Savings

Annual operating cost is estimated to be \$300,000 for leak detection and repair and recycling. It is assumed that all SF_6 saved during leak detection and maintenance activities represents a cost savings because the facility SF_6 purchase and consumption rate will decrease. The cost savings from reduced consumption and purchase is estimated at \$420,000 annually, yielding a net cost savings of \$120,000.

Alternative Suppressants in Fire Protection Systems

Overview

This measure will reduce greenhouse gas emissions from fire suppression systems through a variety of potential reduction options including a GWP threshold for fire suppression agents in new systems, leak reductions strategies, and end of life requirements.

Assumptions for GHG Emissions Reduction

The goal of the measure is to reduce emissions to less than 0.1 $MMTCO_2E$ by 2020 with an effort to ensure that HFC banks grow no more than about 10% between 2012 and 2020. Leak reduction efforts could address installed capacity while alternative suppressants may be used to address emissions from future banks. The impact on emission levels will be greatest once a large percentage of the systems have moved to low GWP agents.

Assumptions for Costs and Savings

Costs will differ depending on the implementation of this measure. Costs presented here will be for using low/no GWP alternatives in new total flooding systems instead of HFC-227. Portable systems and leak reduction strategies are expected to be less expensive.

Based on U.S. EPA data and assuming replacement lower GWP agents in systems coming on-line between 2010 and 2015, one-time costs vary from $10 million to $12 million for 2012-2015 with annual costs ranging from $200,000 to a savings of $200,000, depending on the substitute gas. For systems coming online between 2015 and 2020 the one-time cost is approximately $3 to 4 million with annual costs ranging from $70,000 to a savings of $70,000. These estimates are in U.S. 2000 dollars. Converting these to 2007 dollars and annualizing the costs using a 15 year lifetime, the annualized capital costs are approximately $1.8 million. Annual operating costs are approximately $0.2 million and savings are approximately $0.2 million.

Residential Refrigeration Early Retirement Program

Overview

This measure involves establishing a voluntary program to upgrade pre-2000, less energy efficient residential refrigeration equipment such as refrigerators and freezers and ensure proper recovery of refrigerants and blowing agents that have a high-GWP. The measure would include developing strategies to support appliance take-back/upgrade and early retirement programs such as the U.S. EPA Responsible Appliance Disposal (RAD) program and EnergyStar program, in addition to programs administered by local utilities to address direct and indirect GHG emission reductions from domestic appliances.

Assumptions for GHG Emissions Reduction

Based on literature review and data available through the U.S. EPA RAD Program the following assumptions and determinations are made in the GHG reductions estimate:

- Currently in California up to 1.2 million refrigerators and freezers are disposed of annually.
- Appliances manufactured prior to 1996 used CFC-12 as the refrigerant and CFC-11 as the blowing agent; appliances manufactured from 1996 to 2002 used HFC-134a as the refrigerant and HCFC-141b as the blowing agent; appliances manufactured after 2002 used HFC-134a as the refrigerant and HFC=245fa as the blowing agent
- For domestic appliances the average refrigerant charge is estimated to be 0.5 pound; the average foam blowing agent used is estimated to be 1.0 pound.
- The primary result of this measure is a 25% increase in recycling of appliances to total 1.5 million per year; an increase of 300,000 appliances per year.

- At an appliance end of life 90% of the original refrigerant charge is recovered.
- At an appliance end of life 65% of the initial blowing agent is released – 25% during shredding and an additional 40% after disposal; this GHG emission is mitigated by this measure.

The total reduced emissions for a given year is calculated as follows:

Total Pre-1996 Refrigerator Emission Reduction	=	Total Refrigerators * % Pre 1996 Refrigerators * (½ pound CFC 12 * GWP * 90%) + (1 pound CFC-11 * GWP * 65%)
Total 1996 to 2002 Refrigerator Emission Reduction	=	Total Refrigerators * % 1996 to 2002 Refrigerators * (½ pound HFC-134a * GWP * 90%) + (1 pound HCFC-141b * GWP * 65%)
Total post 2002 Refrigerator Emission Reduction	=	Total Refrigerators * % 1996 to 2002 Refrigerators * (½ pound HFC-134a * GWP * 90%) + (1 pound HCF-245fa * GWP * 65%)
Total Emission Reduction	=	Total Pre-1996 Refrigerator Emission Reduction + Total 1996 to 2002 Refrigerator Emission Reduction + Total post 2002 Refrigerator Emission Reduction

Assumptions for Costs and Savings

Based on literature review and data available through the U.S. EPA RAD Program the following assumptions and determinations are made in the cost and cost savings estimate:

- Incremental costs for purchasing an EnergyStar appliance is $62, so consumer costs = 300,000 * $62, or $19 million.
- Energy savings during the life of an EnergyStar appliance is 700 kWh per appliance, so total energy savings is 700 kWh * 300,000, or 210 million kWh.
- Total utility company costs for appliance recycling programs is $0.03 per kWh saved * 210 million kWh, or $6.3 million.
- In a three-year budget cycle, the total investment in energy efficiency programs in California is $2.7 billion.
- Ratepayer resource savings are $5.4 billion over the life of the programs.
- The cost savings equals total investment of $2.7 billion – total resource savings of $5.4 billion, or $2.8 billion.

Agriculture

Measure A-1: Methane Capture at Large Dairies

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Methane Capture at Large Dairies	1	156	0	156[130]

Overview

This is a voluntary measure to encourage the installation of methane digesters to capture methane emissions from the decomposition of solid and liquid waste at large dairies. The methane could be used as an alternative to natural gas in combustion, power production, or as a transportation fuel.

Assumptions for GHG Emissions Reduction

Manure Management Emission Reduction Assumptions (dairies with 1,000 head or more)

1,781,799 Head	Total California Herd
6.55 Million Metric Tons	Uncontrolled GHG emissions from California Herd
1,392,888 Head	Total SJVAPCD Herd*
78%	SJVAPCD percentage of total California Herd
330,028 Affected Head	Assumes 73% of dairy cows at dairies with 1,000+ head will already be feeding digesters through voluntary action.
1,223,854 Head	Dairy cows, heifers, calves, and bulls at dairies with 1,000+ head not feeding an existing digester
3.676 tonnes CO2e/head	Includes CH4 and N2O
1.2 Million Metric Tons	Uncontrolled emissions from 330,028 head
86%	Control
1.0 Million Metric Tons	Reductions from 330,028 head
330	Dairies with 1,000 or more dairy cows, heifers, calves, and bulls not already feeding a digeser
1,628	Total dairies in California (2006 CDFA data)

*: Includes all cows in Kern County

Assumptions for Costs and Savings

Staff estimates an operating cost of $33M and an annualized cost for installation of digesters at $123M for this measure based on an average capital cost of $3.9M per digester. Savings are not estimated, but are possible through avoided electricity or natural gas purchases, or

[130] The methane capture at large dairies measure is voluntary and therefore not considered in the economic modeling calculations.

through sale of electricity or natural gas. However, the cost for this voluntary measure is not included in the economic modeling as the reduction is not required as part of the AB 32 GHG emissions reduction program.

Cost and Savings Calculation	
Cost per digester	$3.9M
# of large dairies (with more than 1000 head)	330
Capital cost	$1,280M
Capital life	15 years
15-year CRF	0.09634
Annualized capital cost 2020 (capital cost x CRF)	$123.3M
Operating cost 2020 ($100k)	$33M
Total cost 2020	$156M

Forests

Measure F-1: Sustainable Forest Target

GHG Reduction Measure	Potential 2020 Reductions $MMTCO_2E$	Annualized Cost ($Millions)	Savings ($Millions)	Net Annualized Cost ($Millions) [Cost-Savings]
Sustainable Forest Target	5	50	0	50

Overview

Reductions from this target will be achieved through conservation, forest management, reforestation, afforestation urban forestry and fuels management projects. The forest net flux, that is the balance between uptake and emissions, is currently -5 $MMTCO_2E$.

Assumptions for GHG Emissions Reduction

A target reduction of 5 $MMTCO_2E$ is required forest sector to maintain the current net flux based on inventory projections.

Assumptions for Costs and Savings

Staff estimates a net cost of $50M to achieve a 5 $MMTCO_2E$ reduction based on the current voluntary offset price of approximately $10 per $MTCO_2E$.

Climate Change Scoping Plan Appendices

VOLUME III:
CALIFORNIA ENVIRONMENTAL QUALITY ACT FUNCTIONAL EQUIVALENT DOCUMENT

a framework for change

DECEMBER 2008

Pursuant to AB 32
The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

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Appendix J: California Environmental Quality Act Functional Equivalent Document

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I. INTRODUCTION AND BACKGROUND

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine any potentially adverse environmental impacts of ARB's regulations. The measures proposed in this Scoping Plan were developed for the purpose of reducing emissions of greenhouse gases in California as directed by the California Global Warming Solutions Act of 2006 (AB 32, Chapter 488, Statutes of 2006). However, as these measures are developed into rules and regulations and subsequently implemented, there is potential for them to have an adverse environmental impact on natural resources.

This Appendix presents an analysis of potential impacts and also identifies potential mitigation measures that could be implemented to offset or avoid any potentially significant impacts. This Appendix contains an Environmental Checklist, a resource-based discussion of potential cumulative and adverse environmental impacts and mitigations related to each sector by resources category and an accompanying matrix that summarizes the impacts of the Scoping Plan and potential mitigation measures.

A. The California Environmental Quality Act and Functional Equivalency

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potentially adverse environmental impacts of proposed projects. This document presents ARB's analysis of the potential adverse environmental impacts of the Scoping Plan. This document summarizes and discusses the specific strategies in the Scoping Plan that, if adopted and implemented, will reduce greenhouse gas emissions throughout California.

California Public Resources Code §21080.5 allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report once the Secretary of the Resources Agency has certified the regulatory program. The California Secretary for Resources has determined that ARB meets the criteria for a Certified State Regulatory Program (Title 14, California Code of Regulations (CCR) §15251(d)). This certification allows ARB to adopt rules, regulations, standards and plans, and exempts ARB from the requirement to prepare Initial Studies, Notices of Preparation, Negative Declarations or Environmental Impact Reports (EIRs). As a certified agency, however, ARB is required to prepare a substitute document subject to other provisions of CEQA, such as avoiding significant adverse effects on the environment where feasible. ARB has used the Initial Study Checklist as a basis for assessing the potential environmental impacts associated with implementation of the Scoping Plan. This document considers cumulative impacts and addresses adverse activities and impacts associated with the proposed measures. A 45-day review period is provided pursuant to CEQA. ARB will respond to all significant environmental concerns raised by the public during this comment period, or at the Board Hearing.

Scope of Analysis

The scope of the analysis is intended to help focus public review and to assure that any questions and comments are appropriate and meaningful. This Appendix specifically focuses on potential *adverse* environmental impacts.

One of the requirements of AB 32 (Health and Safety Code (HSC) §38561(d) and §38562 (b)(1) and (6)) is for the Scoping Plan to evaluate the total potential costs and benefits of the Plan on the environment and public health. Appendix H presents an analysis of the potential effects of the Scoping Plan on public health and natural resources, and that analysis is incorporated by reference in the scope of this document.

Programmatic Approach

This analysis is necessarily programmatic. It will provide a basis for future environmental analyses and allows future project-specific environmental analysis to focus solely on the new effects or detailed environmental issues not previously considered. A program environmental document allows consideration of broad policy alternatives and program-wide mitigation measures at a time when an agency has greater flexibility to deal with basic problems of cumulative impacts. A programmatic document also plays an important role in establishing a structure within which future reviews and related actions can effectively be conducted. This concept of covering broad policies in a program document and incorporating by reference the information contained therein into subsequent documents for specific projects is known as “tiering” (CEQA Guidelines §15152)

This Appendix cannot and does not contain a detailed quantitative impact analysis for each of the measures in Scoping Plan. Because the Scoping Plan identifies proposed future actions to adopt and implement greenhouse gas reduction regulations for which specific regulatory language has not yet been developed, the analysis is necessarily general and qualitative. This Appendix also does not set forth in detail the beneficial environmental impacts that will result from the proposed Plan. While ARB is proposing the strategies contained in the Plan because they will reduce greenhouse gases, some of the strategies may also benefit air quality, improve public health and reduce our dependency on non-renewable natural resources. An analysis of the positive environmental and air-quality related public health benefits of the Plan is contained in Appendix H.

This functionally equivalent document (FED) is intended to disclose potential adverse impacts and identify potential mitigation measures specific to the Scoping Plan recommendations. This FED may be incorporated by reference for actions that continue to evolve and future measures, regulations and rules that will require additional environmental documentation.

It is important to note that the Plan identifies actions that will be implemented by other agencies, and also that many of the ARB measures are regulatory. For those measures that are regulatory, implementing agencies will be required to complete the regulatory development process and a separate environmental analysis will be prepared. Although

CEQA discourages forecasting and speculation (CEQA Guidelines §15144 and §15145), drafting an environmental document necessarily involves some degree of forecasting. While foreseeing the unforeseeable is not possible, an agency must use its best efforts to find out and disclose all that it reasonably can. Further, if after thorough investigation, a lead agency finds that a particular impact is too speculative for evaluation, the agency should note its conclusion and terminate discussion of the impact. Although ARB provides as much detail as possible in the analysis, it is not possible to provide project or site-specific analysis at this time.

CEQA also requires a specific alternative of "No Project" to be evaluated, and this alternative essentially serves as ARB's baseline for analysis. CEQA documents typically assume that the adoption of a "no project" alternative would result in no further action by the project proponent or lead agency. Some of the measures in the Scoping Plan are already underway and would not be expected to change as a result of the Scoping Plan.

II. ENVIRONMENTAL CHECKLIST

An environmental checklist was used to identify and evaluate potential cumulative impacts of the measures proposed in the Scoping Plan. The environmental impacts checked below indicate those that may be affected by the proposed measures. Further discussion will follow regarding the impacts that measures may have, and potential mitigation strategies that can be implemented to lessen the impacts.

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
I. AESTHETICS. Could the Scoping Plan:			
a) Have a substantial adverse effect on a scenic vista?	☐	X	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	X	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	X	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	X	☐
II. AIR QUALITY. Could the Scoping Plan:			
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	X	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	X	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	X	☐
e) Create objectionable odors affecting a substantial number of people?	☐	X	☐

III. AGRICULTURAL RESOURCES. could the Scoping Plan:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	X	☐	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	X	☐	☐
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	X	☐	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES. Could the Scoping Plan:			
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	X	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	X	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	X	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	X	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	X	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES. Could the Scoping Plan:			
a) Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guideline Section 15064.5?	☐	X	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guideline Section 15064.5?	☐	X	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	X	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	X	☐
VI. ENERGY DEMAND. Could the Scoping Plan:			
a) Conflict with adopted energy conservation plans?	☐	☐	X
b) Result in the need for new or substantially altered power or natural gas utility systems?	X	☐	☐
c) Create any significant effects on peak and base period demands for electricity and other forms of energy?	☐	X	☐
d) Comply with existing energy standards?	☐	☐	X
VII. GEOLOGY AND SOILS. Could the Scoping Plan:			
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	X	☐
ii) Strong seismic ground shaking?	☐	X	☐
iii) Seismic-related ground failure, including liquefaction?	☐	X	☐
iv) Landslides?	☐	X	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	X	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	X	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	X	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
VIII. HAZARDS AND HAZARDOUS MATERIALS. Could the Scoping Plan:			
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	X	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	X	☐
c) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	X	☐
d) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	X	☐
e) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	X
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	X

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
g) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	X	☐
IX. LAND USE AND PLANNING. Could the Scoping Plan:			
a) Physically divide an established community?	☐	X	☐
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	X	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	X
X. MINERAL RESOURCES. Could the Scoping Plan:			
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	X	☐
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
XI. NOISE. Would the Scoping Plan:			
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	X	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	X	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	X	☐	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	X	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	X
XII. POPULATION AND HOUSING. Could the Scoping Plan:			
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	X	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	X	☐

XIII. PUBLIC SERVICES. Would the Scoping Plan**:**

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:			
Fire protection?	☐	X	☐
Police protection?	☐	☐	X
Schools?	☐	☐	X
Parks?	☐	☐	X
Other public facilities?	☐	☐	X

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
XIV. RECREATION			
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	X
XV. SOLID/HAZARDOUS WASTE. Could the Scoping Plan:			
a) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	X	☐
b) Comply with federal, state, and local statutes and regulations related to solid and hazardous waste?	☐	X	☐
XVI. TRANSPORTATION/TRAFFIC. Could the Scoping Plan:			
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	X	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	X	☐
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	X
e) Result in inadequate emergency access?	☐	☐	X
f) Result in inadequate parking capacity?	☐	X	☐
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	X	☐
XVII. WATER QUALITY. Could the Scoping Plan:			
a) Violate any water quality standards or waste discharge requirements?	☐	X	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	X	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	X	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	X	☐
f) Otherwise substantially degrade water quality?	☐	X	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	X	☐
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	X	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	X	☐
j) Inundation by seiche, tsunami, or mudflow?	☐	X	☐

Evaluation of Cumulative Environmental Impacts

	Potentially Significant Impact	Less Than Significant Impact	No Impact
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE			
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	X	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	X	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	X	☐

III. PROPOSED PROJECT DESCRIPTION

Under AB 32, California must reduce greenhouse gas emissions to 1990 levels by 2020. This means reducing greenhouse gas emissions by 169 million metric tons CO_2 equivalent ($MMTCO_2E$) from a projected 596 $MMTCO_2E$ business as usual (BAU) case in 2020. The Scoping Plan provides a recommendation for achieving these reductions through a mix of new and existing policies and regulatory measures, including market mechanisms.

The proposed project is adoption and implementation of the Scoping Plan and the measures described in the plan. The mix of measures included in the Scoping Plan provides a comprehensive approach to reduce emissions to achieve the 2020 target, and to initiate the transformations required to achieve the 2050 target. The cap-and-trade program will cover about 85 percent of greenhouse gas emissions throughout California's economy. ARB staff recognizes that due to several factors, including new information that may be discovered during regulatory development, technology maturity, and implementation challenges, actual reductions from individual measures aimed at achieving the 2020 target may be higher or lower than current estimates. The inclusion of many of these emissions within the cap-and-trade program, along with a margin of safety in the uncapped sectors, will help ensure that the 2020 target is met. The combination of approaches provides certainty that the overall program will meet the target despite some degree of uncertainty in the estimates for any individual measure. In addition, by internalizing the cost of CO_2E emissions throughout the economy, the cap-and-trade program supports the complementary measures and provides further incentives for innovation and continuing emissions reductions from energy producers and consumers, thereby setting California on a path toward the 2050 goal.

ARB staff has also designed the recommendations to ensure that reductions will come from throughout the California economy. Transportation accounts for the largest share of California's greenhouse gas emissions. Accordingly, a large share of the reduction of greenhouse gas emissions from the recommended measures comes from this sector. Measures include the inclusion of transportation fuels in the cap-and-trade program, the Low Carbon Fuel Standard to reduce the carbon intensity of transportation fuels, enforcement of regulations that reduce greenhouse gas emissions from vehicles, and policies to reduce transportation emissions by changes in future land use patterns and community design as well as improvements in public transportation.

In the Energy sector, the recommended measures increase the amount of electricity from renewable energy sources, and improve the energy efficiency of industries, homes and buildings. The inclusion of these sectors and the Industrial sector in the cap-and-trade program provides further assurance that significant cost-effective reductions will be achieved from the sectors that contribute the greatest emissions. Additional energy production from renewable resources may also rely on measures suggested in the Agriculture, Water, and the Recycling and Waste Management Sectors.

Other sectors are also called upon to cut emissions. The cap-and-trade program covers industrial sources and natural gas use. The recommended measures would require industrial processes to examine how to lower their greenhouse gas emissions and be more energy efficient, and would require goods movement operations through California's ports to be more energy efficient. Other measures address waste management, agricultural and forestry practices, as well as the transport and treatment of water throughout the state. Finally, the recommended measures address ways to reduce or eliminate the emissions of high global warming potential gases that, on a per-ton basis, contribute to global warming at a level many times greater than carbon dioxide.

This document discusses the measures and also focuses on the potential adverse environmental impacts that may result from these measures. This document cannot and does not contain a detailed, quantitative impact analysis of the strategies contained in the Scoping Plan. Because the Scoping Plan is a plan for future action to adopt measures and strategies for which specific regulatory language has not yet been developed, this analysis is necessarily general and qualitative. Each strategy and measure will be developed over time. Some may be developed as incentive or voluntary programs, some through future legislation, and some may require further policy decisions by local, regional and state governments. The proposed regulatory measures will undergo further environmental analysis as required by CEQA, and ARB regulations will be discussed at public workshops, and will go through the public hearing process as required by law under the Administrative Procedure Act, (Government Code §11340 et seq.). As specific regulatory proposals are developed, it will be possible to analyze potential environmental impacts in greater detail. In this Appendix, potential environmental impacts are estimated to the extent currently feasible.

ARB incorporates by reference the Programmatic Environmental Impact Report/ Statement (EIR/S) (State Clearinghouse (SCH)# 2001042045) prepared by the High Speed Rail Authority, and its subsequent EIR/Ss. The project requires passage of a bond measure. The additional High Speed Rail (or High Speed Train) projects include the Palm Delta to Los Angeles (SCH# 2007031066), Bay Area to Central Valley (SCH# 2005112051), Los Union Street to Orange County (SCH# 2007031067). Potential and cumulative impacts of the High-Speed Rail project include aesthetics, displacement of commercial and residential properties, disproportionate impacts to minority and low-income populations, community and neighborhood disruption, increased noise and electromagnetic interference along rail corridors, land use policies, traffic impacts associated with stations, effects to historic properties or archaeological sites, impacts to parks and recreation resources, exposure to seismic and flood hazards, water resources, wetlands and sensitive biological species and habitat, land use compatibility, energy use and impacts to agricultural resources. Thus, this FED will not include an environmental analysis for the measure depicted as T-9, the High Speed Rail. The project may proceed with or without adoption of the Scoping Plan.

ARB also incorporates Appendix H of the Scoping Plan by reference in the FED, which discusses the air-quality related public health and environmental benefits of the Scoping Plan measures.

IV. POTENTIAL ADVERSE ENVIRONMENTAL IMPACTS

The basis for analysis originates from the CEQA Initial Study Checklist. The following environmental impact areas are considered for each proposed measure and strategy:

Aesthetics	Land Use and Planning
Air Quality	Mineral Resources
Agricultural Resources	Noise
Biological Resources	Population and Housing
Cultural Resources	Recreation
Energy Demand	Solid Waste
Geology and Soils	Transportation and Traffic
Hazards and Hazardous Materials	Water Resources

Each environmental impact discussion considers impacts that are considered potentially significant and adverse. A reference table identifying each measure in the Scoping Plan, potential adverse impacts, and potential mitigation measures is at the end of this section. It is important to note that some measures are more fully developed than others, and some measures only propose additional research. For those less developed strategies and measures, ARB has attempted to include potential impacts that would be reasonably anticipated given present data and knowledge. Any subsequent regulatory development, new facilities, increases in existing operations and/or throughputs, and subsequent increases in construction activities will be subject to the CEQA (and possibly the National Environmental Policy Act (NEPA)) process and local, regional and state approval on a project-by-project basis.

A. Aesthetics

Cumulative Impact. No element or measure of the Scoping Plan is intended or expected to significantly degrade the natural beauty of California, however, the Scoping Plan contains measures that involve siting and construction of facilities may adversely impact aesthetic values. The measures and their relative impacts and mitigations are discussed below:

TRANSPORTATION
(T-2): Low Carbon Fuel Standard. This measure is undergoing regulatory development for consideration in early 2009. Any impacts associated with aesthetics, siting and construction of facilities supporting the Low Carbon Fuel Standard would be assessed on a location and project-specific basis.

ELECTRCITY AND NATURAL GAS
(E-3): Renewables Portfolio Standard and
(E-4): Million Solar Roofs. Implementation of the Electricity and Natural Gas sector measures in the Scoping Plan may result in impacts to the aesthetic values. The siting and construction of wind or solar farms that would support the expansion of the Renewables Portfolio Standard (RPS) may affect viewsheds. Careful siting of these facilities will avoid impacts so that such a project would not substantially affect a scenic vista, damage scenic resources, degrade the existing visual character or quality of the area, or create new sources of light or glare. A utility scale facility may require a relatively large area if it is to be used to generate electricity at a commercial scale. Large solar facilities may have numerous highly geometric and sometimes highly reflective surfaces, and may create visual impacts; however being visible is not necessarily the same as being intrusive, as aesthetic issues are by their nature highly subjective.[1] Any future development of facilities or infrastructure that would result in a physical change to the visual environment would be subject to the CEQA and/or NEPA process and approval by a city, county or agency on a project-by-project basis. A future facility may ultimately have an adverse aesthetic impact on view sheds, but this depends on the location of a project. Therefore, the measures under the Electricity and Natural Gas sector would have less than significant foreseeable aesthetic impacts[2]. There may be increased light glare associated with installation of large arrays of solar panels and the Million Solar Roof initiative measures. The significance to aesthetic values would be location specific, and ARB cannot speculate on the significance of the potential impact.

[1] Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008, and http://solareis.anl.gov,
[2] Ibid.

B. Impacts to Air Quality

Cumulative Impact. The cumulative impact of the Scoping Plan is to substantially improve air quality; however, there may be potentially significant impacts to air quality associated with implementation of the measures in the Transportation, Electricity and Natural Gas, Water, Industry, Recycling and Waste Management, High Global Warming Potential (GWP) and Agriculture Sectors. These potential impacts are discussed below. With mitigation, the potential impacts would be less than significant.

There may be construction-related air quality impacts which should be evaluated on a project-specific basis. Although not anticipated, there may be increases in criteria and toxic pollutants associated with reformulation of products if a regulatory program is not well designed.

A number of the major measures in the Scoping Plan will significantly reduce demand for electricity and natural gas relative to BAU (or the No Project Alternative, as discussed in the Project Alternatives discussion). However, as the State reduces its reliance on coal-fired generation, additional in-state natural gas generation may be required. Because other measures will decrease overall demand for electricity relative to BAU and will increase the share of renewable resources, it is not clear whether this will result in a net increase in natural gas use for electric generation within California. The cumulative impact of implementing the recommended measures will be to decrease California's demand for electricity and natural gas. A potential result of increased in-state electrical generation could be localized air quality impacts due to associated increases in criteria pollutants and toxic air contaminants. California air pollution regulatory programs at the federal state and local levels address individual source emissions from a regional and localized perspective. Local agencies, such as air pollution districts and planning commissions, could also impose more stringent requirements for sources of criteria pollutants and air toxics to address potential cumulative impacts.

As background, there are four major types of impacts that were considered are related to criteria pollutants, air toxics, global warming and stratospheric ozone depletion.

Criteria Pollutants
These are pollutants determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime. Both the California and federal governments have adopted health-based standards for the criteria pollutants that

include ozone, particulate matter (PM10, PM2.5), carbon monoxide (CO), oxides of nitrogen (NOx) and sulfur (SOx) and reactive organic gases (ROG).

Toxic Air Pollutants

These are air pollutants that may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air. However, their high toxicity or health risk may pose a threat to public health even at very low concentrations. In general, for TACs, there is no concentration that does not present some risk. This contrasts with the criteria pollutants for which acceptable levels of exposure can be determined and for which the State and federal governments have set ambient air quality standards. Diesel particulate represents 75 percent of the risk from air toxics in California.

Greenhouse Gases

Greenhouse gases are any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HCFCs), ozone (O3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Stratospheric Ozone Depleting Pollutants

Chemical compounds, such as carbon monoxide, methane, hydrofluorocarbons, chlorofluorocarbons, non-methane hydrocarbons, and nitrogen oxides, which in the presence of solar radiation react with other chemical compounds.

CALIFORNIA CAP AND TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE PARTNER JURISDICTIONS

The proposed cap and trade regulation is not expected to result in adverse air quality impacts. Since greenhouse gas emission sources also emit criteria and toxic air pollutants, ARB anticipates the proposed measure will generally result in overall air quality improvement as it reduces greenhouse gas emissions. The program as well as other related measures applicable to capped sources would be designed to ensure that program implementation is consistent with State air quality plans and related statutory requirements.

Some individuals have raised concerns that the cap-and-trade program could result in localized environmental impacts. These concerns arise from the possibility that under a cap and trade program, a source of greenhouse gas emissions that impacts a local community adversely impacted by criteria pollutants or toxic air contaminants would not be required to reduce on-site emissions, but instead could obtain allowances or offsets equal to the existing greenhouse gas emissions at their facility. While greenhouse gas emissions have no direct public health impacts, the processes that

result in greenhouse gas emissions also typically emit criteria pollutants and toxic air contaminants that can pose direct and adverse health effects on exposed populations. The cap-and-trade program places a requirement on covered sources of greenhouse gas emissions to surrender allowances equal to their total emissions. This requirement would not exist in the absence of implementation of the Scoping Plan. While the cap-and-trade program would allow facilities to obtain allowances or offsets rather than making on-site reductions, this requirement would not provide an incentive for facilities to increase emissions beyond the levels expected in absence of implementing AB 32. While some localized impacts could result from overall implementation of AB 32, such as increased operation of in-state power plants to replace imported electricity that has higher greenhouse gas emissions, these would not be a direct result of the cap-and-trade program. These possible impacts are addressed in the discussion of cumulative air quality impacts.

Before including a market mechanism in any regulation, ARB must, to the extent feasible, "consider the potential for direct, indirect, and cumulative emission impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution" and design its cap-and-trade program "to prevent any increase in the emissions of toxic air contaminants or criteria pollutants" and "maximize additional environmental and economic benefits for California" (HSC §38570 et seq). During the development of regulations for the cap-and-trade program, ARB will evaluate the program design to ensure that the program meets AB 32 requirements related to the protection of public health as well as ARB's environmental justice policies.[3] Local agencies, such as air pollution districts and planning commissions, could also impose more stringent requirements for sources of criteria pollutants and air toxics to address potential cumulative impacts.

Capped sectors would include electricity, transportation fuels, natural gas, and large industrial sources. Under the proposed measure, the total amount of greenhouse gas emissions from industrial sources and electricity generation would be capped starting in 2012, and decline over time through 2020. The overall cap would be set at a level approximately 30 percent below business-as-usual projections for 2020. Greenhouse gas emissions from commercial and residential fuel use (e.g., natural gas and propane) and transportation fuels would be capped beginning in 2015. The proposed measure includes allowing the limited use of surplus reductions from non-capped sources, called offsets, which are additional to reductions required by AB 32. They would be subject to stringent criteria and verification procedures to ensure their enforceability and consistency with AB 32 requirements.

Although not directly a result of a cap and trade program, a new source of greenhouse gas emissions may present a potential for adverse localized air quality impacts in a community already adversely impacted by criteria pollutants or toxic air contaminants. While greenhouse gas emissions have no direct public health impacts,

[3] http://www.arb.ca.gov/ch/programs/ej/ejpolicies.pdf, December, 2001

the processes involved in manufacturing and electricity generation that would be capped sources also emit criteria pollutants and toxic air contaminants, which can pose direct and adverse health effects on exposed populations; however, California air pollution regulatory requirements at the federal, state, and local levels address individual source emissions from a regional and localized perspective.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard.

The Low Carbon Fuel Standard (LCFS) is currently undergoing regulatory development in parallel with the AB 32 Scoping Plan. The goal of the LCFS is to reduce the carbon intensity of transportation fuels by at least 10 percent by 2020. Carbon intensity is a representation of the greenhouse gas emissions associated with the lifecycle impacts of producing, transporting, and using the fuel.

There will be a variety of options fuel producers can use to meet this standard which makes the environmental impact of the LCFS a difficult measure to examine in the context of the Scoping Plan. Furthermore, a reduction in carbon intensity does not directly relate to a specific change in criteria or toxic pollutants or in fuel combustion. The LCFS regulatory proposal will contain a more detailed analysis of the potential air quality impacts. Such impacts include the evaluation of the lifecycle greenhouse gas emissions and environmental impacts, potential air quality impacts associated with the production, transportation and use of the fuels, and an assessment of the potential localized and cumulative air quality impacts of building in-state production facilities.

ARB is examining the potential sources and types of air emissions associated with identified lower-carbon fuel that may be used in the implementation of the LCFS. One goal of the LCFS is to maintain or reduce criteria and toxic pollutant emissions. Although ARB expects the LCFS will reduce these criteria pollutants, to be conservative in this analysis ARB has assumed no change in criteria or toxic pollutants. As discussed above, the regulation will more fully document and quantify potential air quality impacts or benefits, and will consider the impacts of the life cycle of each fuel path. As appropriate, the lifecycle analysis will also include an evaluation of greenhouse gas emissions associated with indirect land use changes, and other identified indirect impacts associated with the fuels included in the LCFS.

Low carbon fuels that may be used to comply with the LCFS include low carbon ethanol and biodiesel, natural gas, electricity and hydrogen. Potential fuel sources will be discussed in this evaluation, and potential fuel end uses (e.g., vehicles, energy plants) are discussed under relevant measures in other sectors.

Biofuels: Biofuels is a general term used to describe various fuels produced from renewable sources. These include alcohol fuels, such as ethanol, various types of biodiesel and renewable diesel fuel, and others. Biofuels can be produced from food

crops such as corn-derived ethanol or soy beans. Biofuels can also be produced from non-food crops (e.g., switchgrass, algae), biomass waste residues (including cellulosic residues, municipal waste, forest trimmings, etc.), and vegetable oils (often used cooking oils). Biomass produced from waste residue is expected to play a large role in the latter years due to its expected very low carbon intensity. Biofuels can be used to produce blends of conventional fuels (e.g., gasoline and ethanol; biodiesel and diesel fuel; or can be used as essentially 100 percent biofuels). In addition, some processes are designed to produce fuels that can be used to directly replace conventional fuels, such as renewable diesel fuel.

In addition to California's proposed LCFS, the federal Energy Independence and Security Act (EISA) of 2007 (which revised the federal Renewable Fuel Standard (RFS)) promotes the production of biofuels, especially advanced renewable biofuels derived from cellulosic and waste sources. The federal RFS establishes targets for the production of biofuels derived from cellulosic and waste sources. The federal RFS establishes targets for the production of biofuels with a goal of using 36 billion gallons of renewable fuels per year in 2022.

In order to meet LCFS and federal RFS requirement, it is estimated that California will need to use up to 3 billion gallons of renewable fuel per year by 2020. The actual volume of renewable fuel required in California is not yet known; however, this volume is projected based on California's current consumption of approximately 11 percent of the nation's transportation fuels.

The air emissions associated with acquiring each of these biofuel sources can vary considerably. Some factors that affect the air emissions are described below.

- Recycling of waste materials such as municipal solid waste and green wastes, and agricultural or forest residues to produce biofuels will not typically create a new emission source, and is environmentally preferable to traditional disposal. There are emissions associated with truck trips for collecting these materials, but they most likely do not result in a net increase in co-pollutant or greenhouse gas emissions as they would replace disposal-related truck trips.

- Food crop production for biofuels may create new emission sources for acquiring the feedstock. This would not occur if this is merely a redirection of existing food production to fuel production. It is expected that energy crops will not likely be grown to any significant extent in California. Therefore, ethanol derived from corn is limited largely to the volume imported and the need to still meet the original need for importing corn. Furthermore, it is expected that LCFS biofuel production in California will shift toward the use of waste resources. The potential for greenhouse gas emission from land use conversion is discussed in the Land Resource portion of this evaluation.

- Critical factors in determining air emissions for acquiring the feedstock include where the feedstock is produced (which will impact both other resources needed for production, as well as rail and other transportation-related emissions), whether the biofuel crop is replacing another type of crop (and the difference in air emissions associated with the two crops), and whether the crop is competing with food crops for land. Crop production requires the use of off-road equipment, application of fertilizers and pesticides, and irrigation water. Air emissions from fertilizers and pesticides as well as run-off into streams, rivers and lakes result from traditional agricultural practices. Each of the biofuel production approaches mentioned above has associated air emissions. There are NOx, volatile organic compounds (VOCs), and PM emissions associated with agriculture, as well as emissions associated with truck trips to transport raw material to intermediate processing facilities.

- Non-food crop production for biofuel productions (e.g. energy crops) uses plants that are less resource-intensive (requiring less fertilizer and water), and thus have lower associated air pollutant emissions. The associated truck trip emissions would be expected to be similar to truck trip emissions from food crop production.

- Algae are a relatively newly identified source of biofuels and not yet fully studied.

Biofuel production on a commercial scale will require development of new technologies as well as production of biofuels using conventional biofuel production technology and crop-derived feedstocks. Currently the production capacity of commercial-size biofuel (ethanol and biodiesel) plants ranges from approximately 30 million gallons to 100 million gallons per year.

Production facilities will likely be located in California primarily based on the availability of feedstocks. These will likely be non-crop feedstocks and will include biomass wastes from forestry, municipal solid wastes, agriculture wastes, and waste oils, or will be food crops (i.e. corn) imported from the Midwest. There is competition for certain wastes for use in production of renewable electricity and biomethane. For example, it is expected that most of the forest waste will go to production of renewable electricity and municipal solid waste to produce biomethane, or be converted directly to electricity.

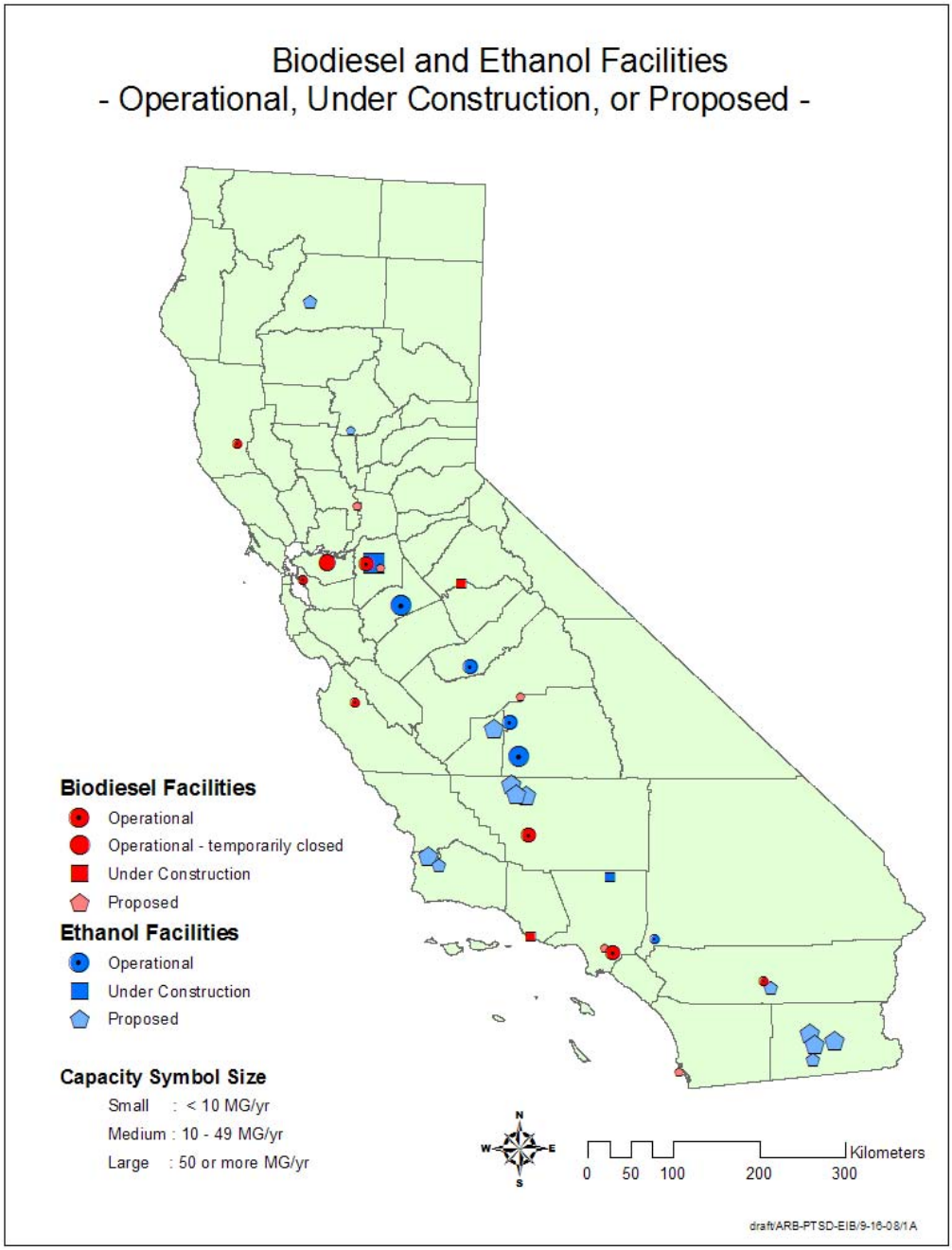
Biofuels will be available to replace both gasoline and diesel with the split between the two fuel types difficult to quantify at this time. In consideration of the competition between potential uses, California biofuel production could reasonably be in the range of 300 million gallons to 1 billion gallons per year. This could result in 10 to 30 new biofuel facilities in California, in addition to existing facilities.

Figure J-1 depicts locations of known and proposed biodiesel and ethanol facilities in California. Figure J-2 displays the feedstocks these facilities are using or propose to use. Note that projections of fuel production will likely change since the use of biofuels (biofuels and ethanol) will be partially driven by the federal EISA as discussed above.

Biodiesel production plants tend to be located close to their feedstocks and secondarily close to rail yards or freeways for distribution to retail sites. Ethanol facilities tend to be located near rail or truck terminals. Siting may also consider proximity to the feedstocks or the users of ethanol co-products. Current biodiesel production facilities are small, ranging from a thousand gallons per year to 30 million gallons per year.

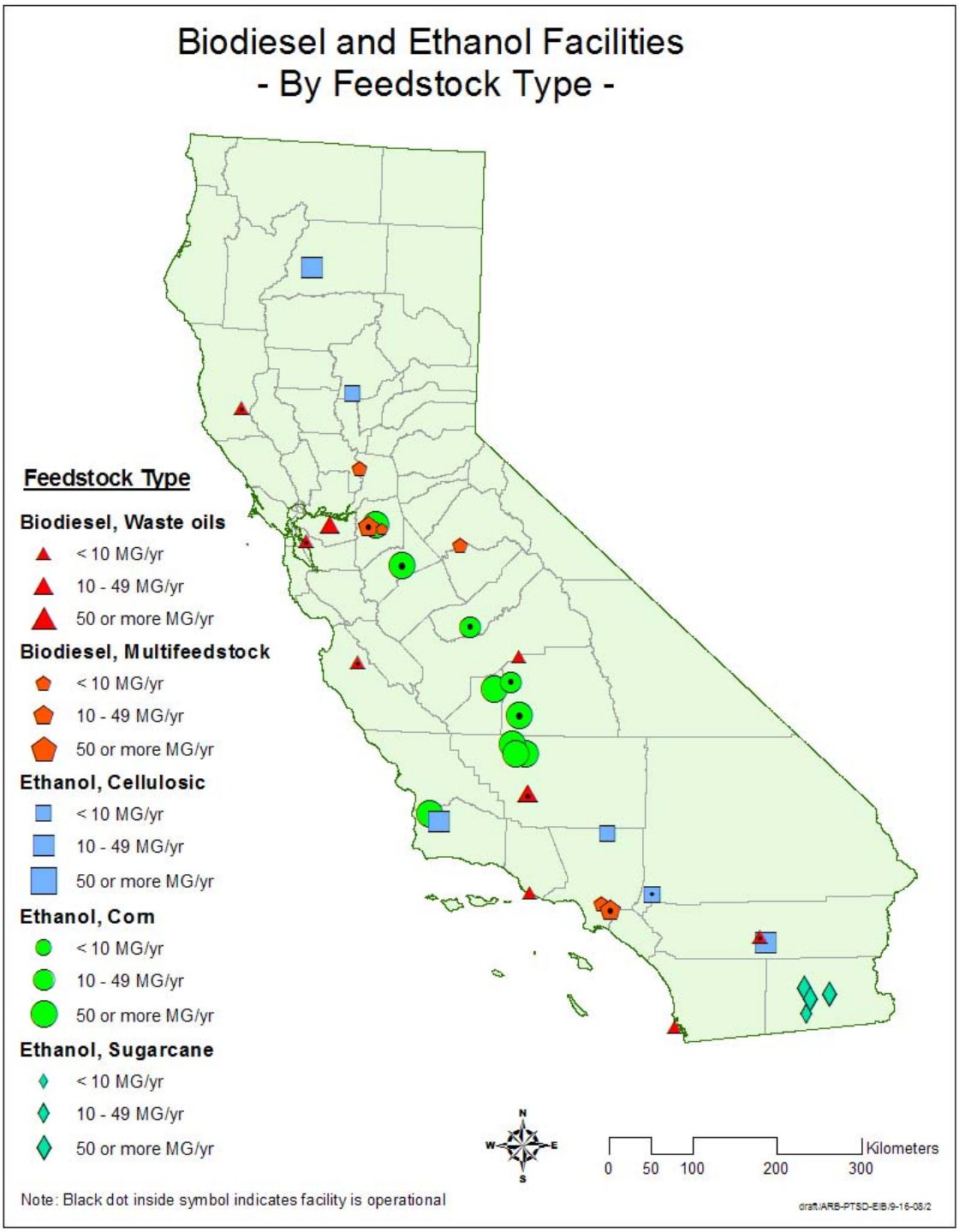
The conversion of biomass feedstocks into energy can result in air quality impacts. Criteria and toxic pollutants, as well as greenhouse gas emissions, will need to be assessed for these facilities during the siting and permitting processes. The pollutants of most concern associated with biomass conversion processes are NOx and VOCs; both are important precursors to the formation of ozone and particulate matter. Particulate matter (PM) emissions, especially from handling feedstocks, also need to be addressed. Greenhouse gas emissions will also need to be considered as part of the siting process and will ultimately be included in the AB 32 process. Finally, any localized criteria or toxic emissions impacts must be considered in the context of localized and cumulative impacts, and impacts on environmental justice concerns.

Figure J-1: Location and Size of Known and Proposed Biodiesel and Ethanol Facilities[4]



[4] Based on ARB staff research

Figure J-2: Feedstocks of Known and Proposed Biodiesel and Ethanol Facilities[5]



[5] Based on ARB staff research

Natural gas: The greenhouse gas emissions from natural gas depend on where it is produced and how it arrives to the final user. The emissions also will vary depending on the form supplied to vehicles either as compressed or liquefied natural gas. Any new distribution facilities including compressors, product quality processors, and liquefaction equipment would have to be permitted and any associated emissions or environmental impacts mitigated.

Hydrogen: Depending upon how it is produced, hydrogen can be a low carbon fuel. As a transportation fuel, hydrogen can be used in either modified internal combustion engines or in fuel cells. Unlike the burning of carbon-based fuels which produces CO_2, CO, NOx, VOC and PM and other potentially toxic compounds, combusting hydrogen produces heat, water, and some oxides of nitrogen. Hydrogen-fueled fuel cell vehicles only produce heat and water vapor.

Like other fuels, hydrogen must be examined over the entire process chain, including the energy needed to produce the fuel as well to compress or cool the hydrogen for storage. Potential hydrogen production methods include electrolysis of water, steam reformation of natural gas, biomass gasification and coal gasification. Today, the two most common ways to produce hydrogen are steam reformation of natural gas and electrolysis of water. Hydrogen produced using electricity generated from renewable resources and used to power fuel cell vehicles results in extremely low air emissions. Senate Bill 1505 (Lowenthal, Chapter 877, Statutes of 2006) directs ARB to develop environmental regulations for the production of hydrogen for transportation use, a process that started in late 2007.

Electricity: Increasing the number of electric vehicles and plug-in hybrids would substantially lower the carbon intensity of transportation fuels. The co-pollutant emissions associated with electricity as a transportation fuel are expected to be the same as the co-pollutant emissions associated with electricity overall. An increase in the number of electric vehicles and plug-in hybrids would not adversely impact air quality. Off peak loads would increase significantly and grid-rechargeable electric vehicle penetration increases. This increased load would produce some increase in greenhouse gas and co-pollutants from base load plants. Such increases in criteria pollutants and greenhouse gas would be more than offset however, by the displacement of internal combustion vehicles.

(T-5): Ship Electrification at Ports.

In December 2007, ARB adopted the shore power regulation, a Discrete Early Action measure, which will be enforceable starting in 2010. This regulation is included in the State Implementation Plan (SIP) and as part of the regulatory package, and has its own environmental analysis. This measure reduces emissions by allowing ships to shut down the uncontrolled auxiliary engines which traditionally have powered these electric-based activities. A transfer of emissions from ships to power plants may

result in localized impacts. Criteria pollutants associated with incremental electricity generation at power plants would be significantly less than emissions generated by ship engines.

(T-6): Goods Movement. The Goods Movement Emissions Reduction Plan (GMERP) identifies opportunities to improve the efficiency of goods movement, particularly through tracking and better scheduling of activities. The proposed measure adds to this concept by proposing that efficiencies to reduce greenhouse gas emissions also be considered. Although the following strategies are not likely to adversely impact air quality, further evaluation is needed to verify whether specific mitigation measures are needed.

- **Clean (Green) Ships:** This measure proposes to incentivize increased fuel efficiency of ships, such as improving engine efficiency, as well as other technologies that reduce greenhouse gas and NOx. This measure is also included in the 2007 SIP. A voluntary program to reduce vessel speeds at the Ports of Long Beach and Los Angeles may be expanded to ocean going vessels that travel along the State's coastline. The employment of wind assistance is also being explored. No adverse impacts to air quality are anticipated, but the measure is not fully developed at this time.

- **Commercial Harbor Craft:** This measure would develop best management practices and outreach to encourage regular maintenance, the use of non-toxic antifouling materials, vessel speed reduction, and engine efficiency of commercial harbor craft. Air emission reductions have not been quantified, but since the main intention is to reduce criteria pollutants and toxic air contaminants, no adverse impacts to air quality are expected.

- **Cargo Handling Equipment:** Reducing the idling times of diesel-powered equipment could potentially reduce associated criteria pollutants. A future study of idling occurrences and emissions will determine the potential for air emission reductions. This measure is included in the 2007 SIP.

- **Transport Refrigeration Units (TRUs):** Transport Refrigeration Units (TRUs) are refrigeration systems usually powered by diesel internal combustion engines designed to refrigerate or heat perishable products that are transported in various containers, including semi-trailers, truck vans, shipping containers, and rail cars. ARB adopted an Airborne Toxic Control Measure (ATCM) regulation to reduce emissions from in-use TRUs in 2004. This measure is included in the 2007 SIP, and ARB is now evaluating the feasibility of regulations to further reduce air toxic emissions from TRUs by eliminating the use of diesel fuel. No adverse impacts to air quality are anticipated.

ELECTRICITY AND NATURAL GAS

Efficiency and conservation measures, solar water heating and solar roofs that collectively reduce peak demand are likely to reduce air emissions, as aging, less efficient power plants are more likely to be operated when demand is high. Thus, no adverse air quality impacts are anticipated for energy efficiency and conservation measures. Measures in this Sector that have the potential to adversely affect air quality include Increasing Combined Heat and Power, and the Renewables Portfolio Standard.

Reduced reliance on out-of state power plants with high greenhouse gas emissions results in increased electricity generation in California, so consequently there may be emissions related to electricity generation. Implementation of the Scoping Plan will result in lower electricity demand and increased reliance on renewable resources, but the relationship to increased or decreased emissions cannot be determined at this time.

(E-2): Increasing Combined Heat and Power. Combustion-based power plants do not convert all of their available energy into electricity and typically lose more than half of the energy as excess heat. At the same time, there are many industrial facilities that require both electricity and heat which currently purchase electricity from the grid and burn natural gas to generate heat. Combined heat and power (CHP) systems generate both electricity and thermal energy on site. When the systems are optimally sized to either meet the heat load of the industrial facility or provide the maximum amount of electricity that the facility could use during peak demand, excess electricity is produced that could be distributed to other electricity users. Combined heat and power can be a more efficient use of the energy contained in fuel, and may also reduce the need to develop new or expand existing power plants.

As this measure is designed, no adverse impacts are anticipated, however, this is potential for local adverse impacts in the event that individual CHP units are not installed in accordance with this measure. ARB cannot speculate on the significance of the impact at this time.

(E-3): Renewables Portfolio Standard. This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. Currently, California's energy profile includes 12 percent renewable sources. The requirement to increase renewable energy could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons, the impacts of each of the renewable resources are evaluated relative to electrical grid natural gas, and are not individually quantified for potential air emissions.

There are air quality impacts associated with the construction of facilities to harness renewable resources – primarily from fugitive dust and diesel particulates from operation of construction equipment. These are assumed to be similar in nature to the construction-related emissions from natural gas-powered power plants, although the location and size of facilities can affect the magnitude and duration of these impacts. These impacts may be temporarily significant, and would be mitigated by employment of best management practices to minimize dust. ARB's implementation of the Diesel Risk Reduction Plan includes reducing diesel particulates from construction equipment operation by 2020, and compliance with this regulation will help mitigate adverse impacts associated with construction.

The remainder of this section focuses on the adverse impacts associated with operation and maintenance of renewable resource facilities.

Wind and solar energy would not adversely impact air quality. Wind power operation and solar energy do not have any associated air emissions.

Biomass energy is harnessed through the combustion of organic waste materials, residuals or agricultural products. Air emissions from biomass sources depend on the fuel type. These are also indirect emissions associated with the production, transportation, and/or disposal of the fuel source. Indirect emissions (from trucks and/or rail) are discussed in the Transportation section above.

Biomass (forest or agricultural residuals) or municipal solid waste (MSW) may be pre-processed and then combusted to generate electricity. Biomass combustion must be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as biomass combustion generates 17 times the amount of NOx and 27 times the amount of PM as electrical grid natural gas power plants per MWh.[6] MSW combustion must also be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as MSW combustion generates 24 times the amount of NOx and 5 times the amount of PM as electrical grid natural gas power plants (per megawatt-hour (MWh)). In some areas of the state, agricultural residuals are burned in open fires as a means of disposal. If the residuals used in a biomass plant were disposed of in open fires, burning the residuals in a biomass plant would reduce the air emissions while also producing electricity. All of these emissions can be minimized with modern control technologies and through good plant design.

Biogas. The anaerobic digestion of human or animal waste produces a gas of 50 to 80 percent methane. This "biogas" can be combusted to produce electricity. Combustion of digester gases must also be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as MSW combustion generates 22 times the

[6] Estimates are based on renewable power generation emission factors developed from ARB surveys and emission inventories in 2000-2001, conducted during the California electricity crisis.

amount of NOx and 9 times the amount of PM as electrical grid natural gas power plants (per MWh).

Combustion of **landfill gases** (mostly methane) to produce electricity puts methane to use that would otherwise be flared to control the methane emissions. Combustion is also used to reduce the toxic air contaminants associated with some landfills. Combustion of landfill gases must be controlled to limit emissions of NOx, particulate matter and carbon monoxide, as its combustion generates 27 times the amount of NOx and 7 times the amount of PM as electrical grid natural gas power plants (per MWh). All of these emissions can be minimized with modern control technologies and through good plant design.

Geothermal energy harnesses naturally occurring geothermal formations, using the steam to produce electricity and returning spent brine to the geothermal resource. Emissions associated with geothermal sources can include hydrogen sulfide, arsenic, mercury, radon 22, and ammonia. The cooling towers at geothermal power plants can emit particulate matter. All of these emissions can be minimized with modern control technologies and through good plant design.

Hydroelectric power uses the potential energy of water to turn turbines that generate electricity. These types of projects do not have associated air emissions.

The addition of significant new renewable resources may also alter the needed transmission infrastructure as renewable facilities are constructed to maximize resource capture at sites with optimal wind, solar, and geothermal resources. ARB has not evaluated the air quality impacts of changes or additions to transmission infrastructure, but notes that there is an ongoing process to examine this issue for several western states and provinces – the Renewable Energy Transmission Initiative (RETI). The RETI is also prioritizing the addition of specific renewable projects to optimize the efficiency and minimize the environmental impact of new transmission infrastructure. There are no long-term air emissions associated with transmission lines, but there are short-term co-pollutant emissions associated with construction that can be minimized through best practices and project design. All of these emissions can be minimized with modern control technologies and through good plant design.

WATER

This sector involves six measures that include Water Use Efficiency, Water Recycling, Water System Energy Efficiency, Reuse Urban Runoff, Increasing Renewable Energy Production, and implementing a Public Goods Charge. The Water Use Efficiency, Water System Energy Efficiency and Public Goods Charge measures are not anticipated to result in adverse impacts to air quality.

(W-2): Water Recycling and
(W-4): Reuse Urban Runoff. These proposed measures may adversely impact air quality due to construction of water capture and storage facilities, as excavation and grading activities may produce short-term construction impacts, such as dust generation, equipment emissions, and objectionable odors. Impacts associated with Low Impact Development would generally be part of the impacts associated with land development projects. Local jurisdictions and air pollution control districts require measures to mitigate construction impacts, such as preparation of grading plans, sprinkling to minimize dust, prohibition on idling equipment and restricted hours of operation. These measures would result in less than significant impacts to air quality with mitigation.

(W-5): Increase Renewable Energy Production. This measure may result in significant impacts to air quality due to new projects; however, this would be evaluated by lead agencies and the California Energy Commission (CEC) on a project-specific basis. This measure overlaps with the Renewables Portfolio Standard (E-3). The potential air quality impacts are discussed in that section.

INDUSTRY
The measures in the Industry Sector involve audits, system efficiency improvements and regulatory changes. Except for possible construction-related air quality impacts, no adverse impacts to air quality are anticipated, however, as these strategies move forward ARB will further evaluate environmental impacts during regulatory development.

RECYCLING AND WASTE MANAGEMENT
(RW-1): Landfill Methane Control. The implementation of the Landfill Methane Control measure involves installation of control devices such as flares and energy recovery systems in order to further reduce greenhouse gas emissions caused by methane. These activities may slightly increase criteria pollutant emissions such as NOx and carbon monoxide (CO) above current levels. Measureable but variable amounts of toxic compounds such as benzene, vinyl chloride, and other carcinogens may be detected in landfill gas at some facilities. To mitigate, any increase in the generation of NOx and CO as a result of landfill gas combusting will need to be included by the affected district in its emission inventory, and depending on a district's non-attainment status, offsets may be required, typically for landfill gas-to-energy projects. This measure does not require the installation of gas-to-energy projects. Gas collection systems with flares or other combustion devices are currently the best means of reducing methane and the potential risk to surrounding populations.

(RW-3): High Recycling/ Zero Waste. This measure includes a suite of strategies, one of which is Composting. Compost facilities are regulated under California Code of Regulations Title 14, Chapter 31. Composting facilities may emit VOCs and NOx, which are criteria pollutants that contribute to ozone formation, but this depends upon

the compost feedstock and emissions control devices on equipment. These facilities may have some region-specific air district permitting requirements. Use of best available control technologies (BACT) would reduce air emissions. According to the California Integrated Waste Management Board's (CIWMB) report, "Emissions Testing of Volatile Organic Compounds from Greenwaste Composting at the Modesto Compost Facility in the San Joaquin Valley," application of a finished compost "blanket" on top of composting materials has the potential to reduce emissions, but should be further studied.

Anaerobic digesters are also included in the suite of strategies. Site and project-specific analysis would be necessary for implementation of the anaerobic digester strategy, as digesters may require a permit action by a responsible agency under CEQA.

HIGH GWP

(H-4): Limit High GWP Use in Consumer Products. This measure involves reformulation to reduce or eliminate fluorinated hydrocarbons, CO_2 and possibly nitrous oxide, which are used as propellants in tire inflator, electronic cleaners, dust removal products, sirens, hobby guns (compressed gas), party products (foam string) and other products. At its June 2008 Board Hearing, ARB approved amendments to the Consumer Products Regulation that will attain approximately a 0.23 $MMTCO_2E$ per year reduction from Pressurized Gas Dusters (2020 reductions). In the 2009-2010 timeframe, staff will evaluate other GHG reduction opportunities from Consumer Products and may propose regulations to attain additional reductions. Consumer Products are also regulated to reduce VOC and TAC emissions. Additional regulations would include analysis to limit the replacement of high GWPs with lower GWPs that could contribute to the formation of ground level ozone.

(H-6): High GWP Reductions from Stationary Sources.

Foam Recovery and Destruction Program. Waste insulation foam that is currently landfilled continues to emit high GWP greenhouse gases into the atmosphere. The measure proposes to recover and destroy waste foam prior to landfilling. If the recovered foams are combusted at treatment facilities, emissions of criteria and toxic pollutants may occur. This program requires further evaluation to determine adverse and beneficial environmental impacts from destruction or reuse practices, which will occur as part of program development.

AGRICULTURE

(A-1): Methane Capture at Large Dairies. This measure is voluntary. This measure would not significantly impact air quality, as digesters are designed to reduce methane emissions, and possibly VOCs from dairy lagoons to produce renewable energy. However, the combustion of biogas in an engine to generate electricity may emit NOx. Emissions controls can reduce the amount of NOx in exhaust gases, but NOx controls for the types and sizes of engines typically used in

conjunction with a dairy digester may not be available, cost effective or able to meet local air district NOx requirements[7,8,9].

[7] Anaerobic Digester Implementation Issues. California Energy Commission, Public Interest Energy Research Program. 2006.
[8] Economic and Technical Advancement Advisory Committee report to the Air Resources Board. Feb. 2008.
[9] Dairy Permitting Advisory Group. Recommendations to the San Joaquin Valley pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley. Jan. 2006.

C. Impacts to Agricultural Resources

Cumulative Impact. The Scoping Plan measures may result in significant impacts to agricultural resources. The conversion of prime farmland, unique farmland or farmland of statewide importance due to siting of new facilities and its associated supporting infrastructure, or conflict with an existing Williamson Act contract may be significant. Further, the loss of food and fiber for fuel may increase the cost of food if the acreage had formerly been used to grow food crops. With mitigation measures such as avoidance of siting facilities on prime farmland, supporting the California Farmland Conservancy Program, working cooperatively with the landowners, and ensuring conformity with existing Williamson Act contracts, impacts would be substantially mitigated. Existing stationary source locations are presently, and would continue to be, primarily designated as heavy industrial land uses.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard. While future facilities that support the Low Carbon Fuel Standard may be sited on prime agricultural lands, this is unlikely as prime agricultural land is too valuable to be used to grow crops for biofuel production. If siting of facilities results in the conversion of agricultural land, this would be subject to the CEQA process and approval by the city or county on a project-by-project basis. Siting of new stationary sources that convert biomass to fuel may convert prime farmland to other uses – the degree of which would be determined locally, and may conflict with an existing Williamson Act contract. Facilities associated with the Low Carbon Fuel Standard measure would require local approval of conditional use permits, local air permits and possibly waste discharge requirements and would be subject to project-specific compliance with CEQA. Such conversion could be mitigated via a financial throughput mechanism that supports the California Department of Conservation's California Farmland Conservancy Program. Avoidance of siting a facility on Williamson Act contracted land would alleviate potential impacts associated with contract conflicts.

ELECTRICITY AND NATURAL GAS

(E-3): Renewables Portfolio Standard. The siting or expansion of new or existing facilities, and the change of crop from food and fiber to fuel could be potentially significant, depending on a site's soils characteristics and productivity, whether the area has been designated as prime farmland and location or whether a facility is under Williamson Act contract. Mitigation measures include but are not limited to avoidance, supporting California Farmland Conservancy Program or other agricultural easement programs to secure easements, alignment with existing right-of-ways, working cooperatively with land owners in design of project features and providing appropriate financial support to landowners if land is acquired.

WATER

(W-3): Water System Energy Efficiency and
(W-5): Increase Renewable Energy Production. New support facilities may convert or disturb agricultural or natural lands. Project-specific analysis would be necessary.

AGRICULTURE

(A-1): Methane Capture at Large Dairies. Although ARB believes siting of manure digesters on dairy lands would not be a significant impact, the siting of digesters may not be compatible with existing Williamson Act contracts. The landowner is encouraged to check with the city or county to ensure compatibility on a project by project basis.

D. Impacts to Biological Resources

Cumulative Impacts. The measures in the Scoping Plan may adversely impact biological resources when new facilities are sited and constructed or existing facilities are expanded. Project and site-specific analysis and coordination with federal, state and local agencies would be necessary to obtain pertinent information regarding sensitive species within and surrounding a project area. Mitigation measures would be dependent upon the site survey and analyses. The Renewables Portfolio Standard and the Low Carbon Fuel Standard have the greatest potential to impact biological resources and adversely impact sensitive species. Project-level compliance with CEQA, and if appropriate, NEPA would be necessary. Several Water sector measures and the Agriculture measure may impact biological resources as these involve planning, siting, construction of facilities. Until the proposed locations of the facilities are known, it is not possible to determine significance of impact.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard. When converting natural lands or farmlands to industrial or a utility-scale facility, such as an ethanol facility, any adverse impacts are required to be addressed and mitigated through CEQA. These impacts could be to terrestrial, riparian, or aquatic habitat, natural communities, or to any species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service, or §404 of the Clean Water Act. A facility may interfere with the movement of any native resident or migratory fish or wildlife species with established migratory corridors, or it may conflict with the provisions of an adopted Habitat Conservation Plan or other approved local, regional or state habitat conservation plan.

In addition, the refining, marketing and distribution of petroleum fuels may adversely impact water quality due to leaks, spills, and wastewater discharge. These water quality impacts can also impair important habitat, or interfere with critical life-cycles of native species. Any reduction in petroleum fuel use would reduce the opportunity for such occurrences.

Some biofuels feedstocks have the potential to affect native species and biological resources, if feedstocks are produced though conversion of important habitat to agriculture or increase agricultural activities in species' corridors.

Hydrogen production and use should have little or no affect on native species and biological resources outside of any potential effects from its energy and water source.

Specific information will be evaluated as the measures and regulations are further developed; each regulation is required to have its own environmental evaluation.

CEQA and possibly NEPA compliance would be required for each facility with its project-specific environmental evaluation. Figure J-1 depicts known and proposed locations of biofuel facilities.

ELECTRICITY AND NATURAL GAS

(E-3): Renewables Portfolio Standard. Siting of new utility scale facilities and arrays may convert natural lands to other uses – the degree of which would be determined locally. Any utility scale facility may require a relatively large area if it is to be used to generate electricity at a commercial scale, and large arrays of solar collectors may interfere with natural sunlight, rainfall, and drainage which could have a variety of effects on plants and animals. Solar arrays may also create avian perching opportunities that could affect both bird and prey populations. A wind farm may present a potential risk to migrating birds if the facility is sited in a flyway. Careful siting and design of such a facility would minimize the risk for bird strikes.

Of note, a solar thermal plant requires around 50 times more land than combined cycle natural gas fueled power plant per MW. Construction activities associated with solar thermal plants disturb the land, and fencing can interfere with wildlife corridors. Nitrogen dioxide and particulate matter deposition from cooling towers at solar thermal plants and new geothermal projects may also degrade vegetation.

When converting natural lands to industrial or usage for utility-scale facilities, there may be adverse impacts to terrestrial, riparian, or aquatic habitat, natural communities, or on any species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations, by the California Department of Fish and Game, the U.S. Fish and Wildlife Service, or §404 of the Clean Water Act. A facility may interfere with the movement of any native resident or migratory fish or wildlife species with established migratory corridors, or it may conflict with the provisions of an adopted Habitat Conservation Plan or other approved local, regional or state habitat conservation plan.

Specific information will be included as the measures and regulations are further developed; each regulation is required to have its own environmental evaluation. CEQA and possibly NEPA compliance would be required for each facility with its project-specific environmental evaluation. Such facilities would require a local approval of conditional use permits, and other permits and would be subject to project-specific compliance with CEQA and NEPA, as appropriate.

WATER

(W-2): Water Recycling,
(W-3): Water System Energy Efficiency,
(W-4): Reuse Urban Runoff, and
(W-5): Increase Renewable Energy Production. Siting and construction of new facilities may convert natural land or disturb biologically sensitive resources. Prior to

implementation of projects associated with these measures, location and project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing entities would be required to contact the appropriate agencies and departments to ensure that potential impacts to sensitive species would be avoided, minimized or mitigated as appropriate. At this time, ARB staff cannot speculate extent or significance of the impacts on biological resources.

AGRICULTURE

(A-1): Methane Capture at Large Dairies. For new or modified dairies and their facilities, operators are required to obtain "Authority to Construct" permits for new construction or modifications, which evaluate the potential CEQA impacts of the proposed project on biological resources prior to granting permits to construct. [10]

[10] Martin, P. March 18, 2008 Update on California Dairy Air Quality Regulations.

E. Impacts to Cultural Resources

Cumulative Impact. Site-specific significant adverse impacts to cultural resources are not expected because the Scoping Plan measures would not require destruction or alteration of any buildings or sites with prehistoric, historic, archeological, religious or ethnic significance. However, some measures in the Scoping Plan, including the **(T-2) Low Carbon Fuel Standard, (E-3) Renewables Portfolio Standard, (W-2) Water Recycling, (W-3) Water System Energy Efficiency (W-4): Reuse Urban Runoff, and (W-5) Increase Renewable Energy Production** may involve siting, grading, construction or expansion of facilities or buildings on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs at the time of construction.

Prior to implementation of projects associated with the Scoping Plan measures, location and project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing entities would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided. As ARB staff cannot speculate on the locations of these resources, it is not possible to ascertain the impacts on cultural resources at this level.

F. Impacts to Energy Demand

Cumulative Impact. A number of the major measures in the Scoping Plan will significantly reduce demand for electricity and natural gas relative to BAU (or the No Project Alternative, as discussed in the Project Alternatives discussion). Some measures, discussed below, will result in moderate increases in energy demand. As the State reduces its reliance on coal-fired generation, additional natural gas generation may be required. Because other measures will decrease overall demand for electricity relative to BAU and will increase the share of renewable resources, it is not clear whether this will result in a net increase in natural gas use for electric generation within California. The cumulative impact of implementing the recommended measures will be to decrease California's demand for electricity and natural gas.

CALIFORNIA CAP AND TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE PARTNER JURISDICTIONS
There may be a shift from internal combustion engines to electric engines, resulting in an increase in energy demand. Although not expected to be significant, it is not possible to definitively determine the level of significance of this potential impact at this time.

TRANSPORTATION
(T-2): Low Carbon Fuel Standard. Future ethanol and other biofuel production facilities in California will likely use natural gas to produce steam and purchase required electricity from a utility. Mitigation would include employment of efficiency and control technologies at facilities and the purchase of offsetting credits. Energy may also be required to move additional natural gas through the pipelines, although this is expected to be minor as the supplies will likely come from existing supplies of natural gas.

Electricity: Increasing the number of electric vehicles and plug-in hybrids would substantially lower the carbon intensity of transportation fuels, but has the potential to increase electricity demand in the long term. Employment of off-peak charging strategies would mitigate to a substantial degree.

(T-5): Ship Electrification at Ports. Allowing ships to run heating, air conditioning, lights, and other operations by plugging into shore-side electrical power would reduce emissions by allowing ships to shut down the uncontrolled auxiliary engines that traditionally have powered these electric-based activities. According to the 2007 SIP, there are toxic air contaminants associated with incremental electricity generation at power plants, but they are significantly less than emissions generated by ship engines. This regulation was evaluated for adverse environmental impacts.

(T-6): Goods Movement. TRUs may increase energy demand through electrification of units. Employment of off peak charging would reduce this impact.

WATER

(W-2): Water Recycling. Water recycling could increase the amount of energy used at local wastewater treatment facilities. To mitigate, wherever possible, water recycling should be performed during off-peak periods.

HIGH GWP

(H-2): SF_6 Limits in Non-Utility and Non-Semiconductor Applications. CalOSHA requires a SF_6 tracer test for fume hoods operating with a specific energy efficient technology. As ARB develops this measure, ARB will need to work with CalOSHA to ensure maintenance of energy conservation efforts.

(H-3): Reduction of Perfluorocarbons in Semiconductor Manufacturing and (H-6): High GWP Reduction From Stationary Sources. Regulatory measures to reduce high GWP emissions from semiconductor manufacturers may require additional energy or electrical use to thermally destroy high GWP gases, as this destruction requires high temperatures. Mitigation measures include purchase and use of highly energy efficient abatement equipment, and catalytic destruction systems which operate at lower temperatures.

G. Impacts to Geology and Soils

Cumulative Impact. At this time, implementation of the Scoping Plan measures (excluding the High Speed Rail projects) are not expected to expose people or structures to potential substantial adverse effects that involve risk of loss, injury or death from rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, landslides, or result in soil erosion or be located on a geologic unit or soils that is unstable. However, some measures in the Scoping Plan, including the **(T-2) Low Carbon Fuel Standard, (E-3) Renewables Portfolio Standard, (W-2) Water Recycling, (W-3) Water System Energy Efficiency and (W-5) Increase Renewable Energy Production** may involve siting, grading, construction or expansion of facilities or buildings on lands. These measures may require disruption or over covering of soil during construction of facilities, there may be changes in topography or surface relief features, the erosion of beach sand, or a change in existing siltation rates. At this time, ARB cannot speculate on the significance, as any future facility siting, construction or expansion would be required to be evaluated on a project specific basis, and would need to comply with state and local requirements that would mitigate impacts.

H. Impacts Associated with Hazardous Materials

Regulatory Background. Hazardous materials are substances with certain physical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed, or otherwise managed. As defined in CCR Title 22 Division 4.5, Chapter 11, Article 3, hazardous materials are grouped into the following four categories based on their properties: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials) and reactive (causes explosions or generates toxic gases). A hazardous waste is any hazardous material that is discarded, abandoned, or otherwise is not recycled. If improperly handled, hazardous materials and wastes can result in public health hazards if released to the soil or groundwater or through airborne releases in vapors, fumes or dust.

Under the Resource Conservation and Recovery Act (RCRA), U.S. EPA regulates the generation, transportation, treatment, storage and disposal of hazardous waste. RCRA was amended in 1984 by the Hazardous and Solid Waste Act (HSWA), which affirmed and extended the concept of regulating the use of certain techniques for the disposal of some types of hazardous wastes. Under RCRA, individual states may implement their own hazardous waste program in lieu of RCRA as long as the state program is at least as stringent as the federal RCRA requirements. U.S. EPA approved California's program to implement federal regulations as of August 1, 1992.

The California Department of Toxic Substance Control (DTSC) administers the Hazardous Waste Control Law (HWCL). Under HWCL, DTSC has adopted extensive regulations governing the generation, transportation, and disposal of hazardous wastes. HWCL differs little from RCRA; both laws impose "cradle to grave" regulatory systems for handling hazardous wastes in a manner that protects human health and the environment. Regulations implementing HWCL are generally more stringent than regulations implementing RCRA. HWCL regulations list more than 780 hazardous chemical, as well as nearly 30 more common materials that may be hazardous, and establish criteria for identifying, packaging, and labeling hazardous wastes. They prescribe management practices for hazardous wastes establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills.

Under both RCRA and HWCL, hazardous waste manifests must be retained by the generator for a minimum of three years. Hazardous waste manifests list a description of the waste, its intended destination, and regulatory information about the waste. A copy of each manifest must be filed with DTSC. The generator must match copies of hazardous waste manifests with certification notices from the treatment, disposal or recycling facility. Hazardous waste as defined in the Code of Federal Regulations Title 40 (40 CFR) 261.20 and CCR Title 22, Article 9 (including listed substance,

40 CFR 261.30) is disposed of in Class I landfills. California has enacted a strict legislation for regulating Class l landfills (HSC §5209 – 25209.7). For example, the treatment zone of a Class I landfill must not extend more than five feet below the initial surface and the base of the zone must be a minimum of five feet above the highest anticipated elevation of underlying groundwater (HSC §25209.1 (h)). The Health and Safety Code also requires Class I landfills to be equipped with liners, a leachate collection and removal system and a groundwater monitoring system (HSC §25209.2(a)). Such systems must meet the requirements of DTSC and the SWRCB (HSC §25209.5).

Cumulative Impact. The purpose of the Scoping Plan is to help California reduce greenhouse gas emissions. Some measures in the Scoping Plan may require the use of hazardous materials, and may require special handling when materials are disposed of. Scoping Plan-related impacts associated with hazards and hazardous materials are expected to be less than significant, and will be further evaluated during regulatory development.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard.

Biodiesel: Biodiesel production uses sodium hydroxide, hexane, sulfuric acid, and methanol. These will be present in any waste generated. Stearates are also likely generated during the esterification process. Glycerol is a co-product that contains unused catalyst, salt, water, methanol, and soaps, and may be recycled and has economic value.

Ethanol: Current state-of-the-art dry milling plants are expected to generate minimal waste, but any waste materials such as hydraulic oil that is generated would require appropriate disposal if they cannot be, reused or reprocessed.

Hydrogen: Precious metals, such as platinum, are expected to be recovered from fuel cells at the end of their useful life. Carbon fiber used in hydrogen tanks is highly valuable as a recycled material.

(T-6): Goods Movement. These measures are not expected to affect waste disposal or hazardous materials, as they do not propose to significantly materially change vehicles, vessels, structures, or equipment. Reduced upstream transport of fuels would reduce the potential for accidental spills.

One maintenance practice to be considered in the commercial harbor craft measure under T-6 is the use of non-toxic anti-fouling products to be used on the hulls to improve hull smoothness. Copper is an active ingredient in some commonly used anti-fouling products. Excess product, spray mixture, and rinseate associated with the application of copper-containing anti-fouling products must be treated, and disposed of, as hazardous waste if it cannot be used or chemically reprocessed. The

encouragement of non-toxic anti-fouling product use and education of owners/operators on the toxicity of copper should reduce the use of and improper disposal of these chemicals.

ENERGY AND NATURAL GAS

(E-1 and CR-1): Energy Efficiency. Appliance and building efficiency standards are designed to reduce energy and water consumption. Overall the appliance and building turnover rate would not result in an accelerated rate of hazardous or municipal solid waste production. Efficiency standards occasionally result in the use of new or new versions of products that contain hazardous materials and require special recycling or disposal, such as ballasts in compact fluorescent bulbs or batteries. Compliance with special waste handling, recycling and disposal laws and regulations would alleviate potential impacts.

(E-3): Renewables Portfolio Standard. Municipal solid waste may contain hazardous materials, which could result in solid and gaseous hazardous by-products when burned for energy. Ash can be recycled or shipped to landfills permitted to accept such waste, and hazardous materials should be diverted prior to combustion. Solar arrays with photovoltaic panels may contain hazardous materials, and although they are sealed under normal operating conditions, there is the potential for environmental contamination if they were damaged or improperly disposed upon decommissioning. Concentrating solar power systems may employ liquids such as oils or molten salts that may be hazardous and present spill risks. Spill-related impacts can be mitigated through proper planning, handling, spill cleanup, and adherence with disposal protocols (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008).

(E-4): Million Solar Roofs. As indicated in E-3, above, photovoltaic panels may contain hazardous materials, and although they are sealed under normal operating conditions, there is the potential for environmental contamination if they were damaged or improperly disposed upon decommissioning. Some solar cell manufacturing requires trace amounts of potentially toxic materials. Proper handling and operation and good maintenance practices can be used to minimize impacts from hazardous materials. Proper planning and good maintenance practices can be used to minimize impacts from hazardous materials (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008).

HIGH GWP

(H-2): SF_6 Limits in Non Utility and Non Semiconductor Applications. One of the proposed measures to reduce SF_6 focuses on its use as a tracer in fume hoods. One possible substitute for SF_6 in this application is N_2O, which is also a greenhouse gas but has far lower greenhouse warming potential. The use of N_2O may pose a risk to vulnerable populations, such as pregnant women, if N_2O is used in place of SF_6 for fume hood tests. Exposure could occur if N_2O is accidentally released. The potential

impact would be mitigated through use of best management practices such as ensuring proper ventilation at exhaust stacks and ensuring only certifiers are in the testing room.

I. Impacts to Land Use and Planning

Cumulative Impact. The Scoping Plan includes a recommended measure to establish a process whereby regions in California integrate development patterns, transportation networks, and other transportation measures and policies in a way that achieves greenhouse gas emission reductions. ARB will work with metropolitan planning organizations to set transportation-related greenhouse gas emissions reductions targets. Shifting land use patterns can improve transportation and build on successful planning processes that integrate sustainable community principles. While worth noting that this impact is significant, it is not adverse.

Some existing facilities, such as landfills, may need to revise their permits in order to implement strategies recommended in the proposed plan. Also, many counties will likely adopt Greenhouse Gas Elements in their General Plans that will translate into updated building codes, energy and water use efficiency measures, and land use decisions. These actions will result in new or revised permitting requirements. Permit approval generally requires compliance with CEQA (or its functional equivalent) and possibly NEPA.

Land use considerations are determined by local governments and no land use or planning requirements would be mandated or altered by the proposed measure. If any federal agencies are involved with the recommended measures in the Scoping Plan, they would be expected to use their land use planning processes to ensure that the public lands are managed in accordance with all applicable laws and regulations under their respective principles of multiple use and sustained yield; recognizing the need for domestic sources of minerals, food, timber and fiber while protecting the quality of the values under their purview.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard. The Low Carbon Fuel Standard is still in the regulatory development process. There are potential land resource issues associated with the biofuels pathways, such as conversion of forestlands, pastureland, and food or fiber to fuel crops. The local jurisdiction having land use authority over such conversion would need to address the potential impacts due to conversion on a project-specific basis.

Biodiesel – Soybeans: The majority of soybeans needed to fill the anticipated 2020 demand for soy-based biodiesel is projected to be produced out of state. Midwestern states and Texas are currently the largest growers of soybeans, and out-of-state biodiesel plants using soybeans tend to be located close to production fields. California could meet future biodiesel demands either through importing soybeans and other raw materials or through importing finished biodiesel. Potential land resource issues related to the use of soybeans to produce fuel include the conversion of undeveloped/natural habitats to agriculture and the conversion of food-based

agriculture lands to fuel-based agriculture lands. These issues will be further evaluated as part of the LCFS regulatory development process.

Biodiesel Production Facilities: Biodiesel production facilities are usually sited based on access to feedstock and the market for the finished product. Production facilities processing out-of-state feedstocks need to be accessible to truck and rail routes. Facilities processing recycled waste tend to be located closer to the sources of that waste – restaurants and industrial facilities. Facilities sited in industrial-zoned areas will already be compatible with existing land use designations since biodiesel production falls into the industrial category. Potential land use impacts could occur if non-compatible areas are rezoned to accommodate the siting of new production facilities.

Ethanol – Corn: Food-to-fuel crop conversion acreage estimates are currently under development as part of the LCFS regulatory process. Potential land resource issues related to the use of corn to produce fuel include the conversion of undeveloped/natural habitats to agriculture and the conversion of food-based agriculture lands to fuel-based agriculture lands. These issues will be further evaluated in the LCFS regulatory development.

Ethanol – Cellulosic: Less is known about the potential land use issues with cellulosic feedstocks, which may be heartier than food crops and thus can be cultivated in locations where food cannot be economically cultivated. Most cellulosic feedstocks will consist of woody waste materials (corn and other crop residues, waste wood chips, forest residues, municipal solid waste and energy crops) which would derive from existing land uses. The only potential land resource issues related to the use of cellulosic materials to produce fuel would occur where (and if) undeveloped/natural habitats or food-based agriculture lands are converted to fuel-based (energy crops) agriculture lands. These issues will be further evaluated in the LCFS regulatory development.

Ethanol Production Facilities: Ethanol production facilities typically need access to sources of feedstock, users of their waste products, and to the market for this finished product. Facilities sited in industrial-zoned areas generally will not cause as many land use concerns as siting in undeveloped areas. Potential land use impacts could occur if non-compatible areas are rezoned to accommodate siting of new ethanol production facilities.

Hydrogen: Hydrogen production stations are typically constructed in developed, populated areas and within zoning that allows for a production station. Stations that use natural gas or on-site solar power as the energy source for production would probably not raise land resource issues if located in developed areas.

The implementation of the LCFS is unlikely to involve any significant conversion of food crop production for biofuel production in California due to the high price of land and current crop production. If this does occur, the potential crop conversion cannot be known at this time. However, the potential impact of the loss of production of food and fiber may be significant, and would require further environmental analysis. The land on which fuels are to be grown may be under Williamson Act contract. The landowner should contact the county to ensure conformity with the terms and conditions of the contract. This impact also relates to the discussion under Agricultural Resources.

(T-3): Regional Transportation-Related Greenhouse Gas Targets. This measure requires the establishment of a process whereby regions integrate development patterns, transportation networks, and other transportation measures and policies in a way that achieves greenhouse gas emission reductions. Achieving significant additional greenhouse gas reductions from changed land use patterns and improved transportation will help achieve the goals of AB 32. While not an adverse impact, this measure will result in a change in land use policies by building on successful Blueprint planning processes, and require metropolitan planning organizations to develop and incorporate sustainable communities strategies.

One of the potential enabling strategies in this measure is to establish an indirect source rule (ISR) for new development. ARB defines an indirect source as "any facility, building, structure or installation, or combination thereof which generates or attracts mobile source activity that results in the emissions of any pollutant for which there is a state ambient air quality standard."[11] This strategy will require its own environmental evaluation.

ELECTRICITY AND NATURAL GAS

(E-3): Renewables Portfolio Standard. Siting of new utility-scale facilities and arrays may conflict with an existing Williamson Act contract, or lands under easement. Avoidance would be the most appropriate mitigation. If land is under easement, the easement conditions must allow such a use. Such facilities may require a local approval of conditional use permits, and other permits and would be subject project-specific compliance with CEQA.

WATER

(W-2): Water Recycling. Projects may conflict with habitat conservation plans or natural community conservation plans. Site-specific, project-level CEQA compliance would be evaluated by appropriate lead agencies.

[11] California Clean Air Act Guidance for the Development of Indirect Source Control Programs, 1990, App.A, p.2

J. Impacts to Mineral Resources

Cumulative Impact. The Scoping Plan measures are not expected to cause any adverse impacts on mineral resources. The measures are not expected to deplete non-renewable mineral resources at an accelerated rate or in a wasteful manner. There are no anticipated significant adverse impacts to mineral resources.

K. Impacts to Noise

Cumulative Impact. Potential adverse noise impacts are not expected to be significant. Many types of equipment generate noise. Construction noise may be potentially significant but is temporary, and can be mitigated through control technologies to a level of less than significant. Implementation of Scoping Plan measures is not expected to result in a substantial increase in noise levels than would otherwise already exist in the course of construction activities during or an industrial process. General Plan Noise Elements and ordinances identify appropriate local noise levels and identify accepted mitigation measures, such as mufflers, limited hours of operation and installation of temporary sound barriers.

(E-3): Renewables Portfolio Standard. Power plants and wind power installations may increase noise levels. General Plan Noise Elements and ordinances identify appropriate noise levels. Accepted mitigation measures may vary with the kind of facility. Limited hours of operation, mufflers, and sound barriers would mitigate the majority of construction and operational noise impacts.

L. Impacts to Population and Housing

Cumulative Impact. The Scoping Plan measures are not expected to cause any adverse impacts to population or housing. The proposed measures are not expected to result in the creation of any industry that would significantly affect population growth, or directly or indirectly induce the construction of single- or multiple-family units. Although relocation is identified as a potential impact in the High Speed Rail measure, the analysis is incorporated by reference for the purposes of the Scoping Plan. No significant population relocation or growth inducement is expected from the measures in the Scoping Plan. Population and housing could increase in areas throughout the state from construction of new homes, but not as a direct result of any of the measures in the Scoping Plan.

(W-2): Water Recycling.
The availability of recycled water may represent an additional water supply that may foster community growth by freeing existing potable water supplies. The extent of community development is established by the General Plan. Availability of water supply created by recycling may be considered by communities during General Plan updates and development proposals. Project-level CEQA evaluation would be necessary. Although this additional water supply is worth noting, it is not considered an adverse impact.

M. Impacts to Public Services

Cumulative Impact. The Scoping Plan measures are not expected to cause any adverse impacts to public services. Any need for public service, such as additional transmission electricity infrastructure that would support the Renewables Portfolio Standard requirements to deliver to consumer would be subject to project-specific CEQA analysis by the CPUC or NEPA analysis by federal agencies.

N. Impacts to Recreation

Cumulative Impact. The Scoping Plan measures are not expected to affect recreational opportunities in the State. To the extent that specific industries propose to construct facilities in protected lands to meet statutory or regulatory requirements, these projects would be required to go through NEPA and CEQA review prior to approval.

The U.S. Department of Interior's Bureau of Land Management is preparing an environmental impact statement (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008) that addresses the siting of solar arrays from lands within the National Landscape Conservation System, such as National Conservation Areas, National Monuments, Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers and National Historic and Scenic Trails, and lands that have been identified as environmentally sensitive.

ELECTRICITY AND NATURAL GAS
(E-3): Renewables Portfolio Standard. Siting and construction of wind or solar farms that would support the expansion of the Renewables Portfolio Standard (RPS) may affect view sheds that may indirectly affect recreational resources.

O. Impacts to Solid Waste

Regulatory Background. Solid waste consists of residential wastes (garbage and rubbish produced by households), construction wastes, commercial and industrial wastes, home appliances and abandoned vehicles, and sludge residues (waste remaining at the end of sewage treatment process). CCR Title 14, Division 7, provides the State standards for the management of facilities that handle and /or dispose of solid waste. CCR Title 14, Division 7 is administered by the California Integrated Waste Management Board (CIWMB) and the designated Local Enforcement Agency (LEA). The LEA for each county is the County Department of Environmental Health, and some cities have LEAs.

CCR Title 14, Division 7, establishes general standards to provided required levels of performance for facilities that handle and /or dispose of solid waste. Other Title 14 requirements include operational plans, closure plans, and post-closure monitoring and maintenance plans. Title 14 covers various solid waste facilities including but not limited to landfills, material recovery facilities (MRF), transfer stations, and composting facilities.

Cumulative Impact. Potential adverse waste impacts are not expected to be significant. The proposed measures are not anticipated to result in a substantial increase in the generation of solid waste or require that any permitted facility to expand its capacity to accommodate increased quantities of waste.

P. Impacts to Transportation and Traffic

Cumulative Impact. The Scoping Plan measures are not expected to cause significant adverse impacts to transportation or traffic. Although many control measures in the Scoping Plan call for emission reductions from motor vehicles, these control measures rely on technological changes, which will not impact transportation or traffic. Construction related impacts associated with the Low Carbon Fuel Standard, Renewables Portfolio Standard, Water or Agriculture sector measures are expected to be temporary. For measures that involve construction of facilities, traffic impacts can be mitigated through ingress and egress controls to mitigate for congestions, and facility design should include appropriate traffic controls such as turn lanes, traffic lights, reduced speed zones to ensure safety.

Under the Scoping Plan, ARB will work with metropolitan planning organizations to set transportation-related greenhouse gas reductions targets, depicted as **(T-3) Regional Transportation – Related Greenhouse Gas Targets**. This recommended measure may result in shifting land use patterns to improve transportation, and build on successful planning processes that integrate sustainable community principles. The measure incorporates several supporting strategies that may affect transportation patterns. While worth noting that this impact may be significant, ARB does not consider it to be adverse.

Q. Impacts to Water Resources

Regulatory Background.

State and Regional Water Boards

California has an extensive regulatory program to control water pollution. The most important statute governing water quality is the Porter-Cologne Act, which gives the State Water Resources Control Board (SWRCB) and the nine regional water quality control boards (RWQCB) broad powers to protect surface and groundwater supplies in California, regulate waste disposal, and require cleanup of hazardous conditions (California Water Code sections 3000-13999.16). In particular, the SWRCB establishes water-related policies and approves water quality control plans, which are implemented and enforced by the RWQCBs. The nine regional boards are: North Coast, San Francisco Bay, Central Coast, Los Angeles, Central Valley, Lahontan, Colorado River Basin, Santa Ana, and San Diego.

It is the responsibility of each regional board to prepare water quality control plans to protect surface and groundwater supplies within its region. These plans must: identify important regional water resources and their beneficial uses, such as domestic, navigational, agricultural, industrial, and recreational; establish water quality objectives, limits, or levels of water constituents or characteristics established for beneficial uses and to prevent nuisances; and present an implementation program necessary to achieve those water quality objectives. These plans also contain technical information for determining waste water discharge requirements and taking enforcement actions. The plans are typically reviewed and updated every three years (California Water Code §13241).

California dischargers of waste that "could affect the quality of the waters of the State" are required to file a report of waste discharge with the appropriate regional water board (California Water Code § 13260). The report is essentially a permit application and must contain information required by the regional board. After receipt of a discharge report, the regional board will issue "waste discharge requirements" analogous to a permit with conditions prescribing the allowable nature of the proposed discharge (California Water Code §3263, 13377, and 13378).

National Pollutant Discharge Elimination System Requirements

Most discharges into California's waters are regulated by the National Pollutant Discharge Elimination System (NPDES), a regulatory program under the federal Clean Water Act. The NPDES is supervised by U.S. EPA, and administered in California by the SWRCB. NPDES requirements apply to discharges of pollutants into navigable waters from point sources, discharges of dredged or fill material into navigable waters, and the disposal of sewage sludge that could result in pollutant that is entering navigable waters. California has received U.S. EPA approval of its NPDES program. Pursuant to California's NPDES program, any waste discharger

subject to the NPDES program must obtain an NPDES permit from the appropriate RWQCB. The permits typically include criteria and water quality objectives for a wide range of constituents. The NPDES program is self-monitoring, requiring periodic effluent sampling. Permit compliance is assessed monthly by the local RWQCB. Any NPDES violations are then categorized and reported to U.S. EPA on a quarterly basis.

U.S. EPA has also published regulations that require certain industries, cities and counties to obtain NPDES permits for stormwater discharges (55CFR (1990)). The regulations set permit application requirements for classes of stormwater discharges specifically identified in the federal Clean Water Act. The regulated stormwater discharges include those associated with industrial activity and from municipal storm sewer systems serving a population of 100,000 or more.

Discharges to Publicly Owned Treatment Works (POTWs)
Water discharges to a public sewage system (referred to generically as a POTW), rather than directly to the environment, are not subject to the NPDES discharge requirement. Instead, such discharges are subject to federal pretreatment requirements under sections 307 (b) and (c) of the Clean Water Act (33 USC § 1317 (b)-(c)). Although these retreatment standards are enforced directly by U.S. EPA, they are implemented by local sanitation districts (Monahan et al., 1993). The discharger, however, has the responsibility to ensure that the waste stream complies with the pretreatment requirements of the local system. Any facility using air pollution control equipment affecting water quality must receive a permit to operate from the local sanitation district. In cases where facilities modify their equipment or install air pollution controls that generate or alter existing wastewater streams, owner/operators must notify the local sanitation district and request that their existing permit be reviewed and modified. To ensure compliance with wastewater pretreatment regulations, local sanitation districts sample and analyze the waste water streams from facilities approximately two to four times per year. Persons who violate California's water quality laws are subject to a wide array of enforcement provisions. In 1990, U.S.EPA revised and extended existing regulations to further regulate hazardous waste dischargers and require effluent testing by POTWs. To comply with revised permit limits, POTWs may alter their operations or impose more stringent local limits on industrial user discharges of hazardous wastes (Monahan et al., 1993). POTWs in California are operated by sanitation districts that adopt ordinances establishing permit systems and fee structures.

Cumulative Impact. Overall, impacts to water demand and water quality are expected to be less than significant, but will also require further analysis as the regulations are developed to ensure protection of the water resources of the State. The Scoping Plan measures would reduce a number of air pollutants, and these reductions in deposition may improve overall water quality in California.

Measures that involve construction may have temporary impacts to surface water that can be mitigated by employing best practices to reduce spills, prevent erosion and sedimentation.

TRANSPORTATION

(T-2): Low Carbon Fuel Standard. ARB compared the potential water resources effects of the Low Carbon Fuel Standard to traditional petroleum fuels.

Biofuels. Water demand will be an important consideration in determining the kind of fuel that may be produced in the State. Based on water demand information related to LCFS, ARB staff estimated that a range from 2 to 6 gallons of water is used to produce 1 gallon of ethanol, compared to 1 gallon of water necessary to produce one gallon of biodiesel. [12], [13] The source of water is also important. Wastewater from biorefineries can contain high levels of biological oxygen demand (BOD), grease and salts, and may not be appropriate for use unless treated prior to application.

The greatest potential impact on water resources by biofuels is the production of feedstock. Agriculture in the United States relies on a mixture of natural rainfall and irrigation, the ratio of which depends on the local climate. Irrigation practices can have a very large effect on the overall water consumption by biofuels. Just as irrigation water demand is highly dependent on location, so is the impact of that water demand. In addition to water demand, the chemicals and fertilizers used on these crops can end up in surface or ground waters, effecting water quality. These issues will be further discussed in the LCFS regulatory development.

The location of these water demands determines their ultimate effect. In the Midwest, where much of the corn and soy beans are grown, historic overdraw of groundwater resources and high organic loading of surface waters would suggest that the additional water demand of biofuel production and increase nitrogen loading of feedstock production could impact existing water resources.

In addition, there may be potential adverse impacts to water quality from different formulations of low-carbon fuels in the event of spills. Depending on formulation, potential for biological effects from fuels such as ethanol, biodiesel, renewable diesel and others exist, in the event that there is a discharge to groundwater or surface waters. For example, ethanol may delay biological degradation of benzene, toluene, ethylbenzene and xylene (BTEX) due to bacterial preference for ethanol (2007 State Implementation Plan). Compliance with SWRCB regulations would avoid or

[12] Pate, R.M. Hightower, C. Cameron, and W. Einfeld, Overview of Energy Water Interdependencies and the Emerging Energy Demands on Water Resources. Report SAND 2007-1349C, Los Alamos, NM, Sandia National Laboratories, 2007
[13] Ibid.

minimize this impact. Also, employment of appropriate spill prevention and spill abatement protocols would alleviate the impact.

Finally, chemicals and fertilizers used on crops used to produce fuel can end up in surface or ground waters, affecting water quality. Mitigation measures such as minimizing use, or use of post fumigation water treatments would protect surface water quality.

Hydrogen: Hydrogen fuel can be created from water (through electrolysis) or from hydrocarbon sources such as natural gas, methanol, or petroleum products (steam reforming). Steam reformation of natural gas is the most common form of hydrogen production in the United States.[14] Each of these processes uses water: in electrolysis energy is used to break apart water bonds to create hydrogen, in reforming steam is used to break apart hydrocarbon bonds. The consumptive water resource requirements for these processes are not well documented, but given the pressures on California's water supplies, these requirements should be quantified within the LCFS regulatory process or within the siting process for hydrogen production facilities.

Also, chemicals and fertilizers used on crops used to produce fuel can end up in surface or ground waters, affecting water quality. Mitigation measures such as minimizing use, use of post fumigation water treatments would protect surface water quality.

WATER

(W-2): Water Recycling. Water recycling reduces the quantity of water entering into downstream flows, water table recharge, and infiltration. If wastewater is relied upon for dilution, this reduction could contribute to higher concentrations of contaminants in downstream waters and/or in water tables. All water recycling facilities must be permitted and operated in accordance with the requirements of the Water Boards and the Department of Public Health. Project-level CEQA compliance would be required.

RECYCLING AND WASTE MANAGEMENT

(RW-1): Landfill Methane Control. This measure may have an adverse impact on water quality as the measure requires collection and control of methane emissions from smaller and uncontrolled landfills. This measure may increase the generation of NOx and CO as a result of landfill gas combustion and during a rain event NOx may be scrubbed out of the air and deposited to open water. Although these emissions cannot be quantified at this time to determine significance of impact, they would need to be included by the affected air district's emission inventory. Depending on a district's non-attainment status, offsets may be required, typically for landfill gas-to-energy projects. While the measure would increase the amount of landfill gas

[14] U.S. Department of Energy. http://www1.eere.energy.gov/hydrogenandfuelcells/education/basics_production.html

condensate generated, existing regulations require storage in double-walled tanks that can be periodically pumped out. The condensate can be transported to a legal disposal facility or treated onsite and disposed of in the local sewer system.

(RW-3): High Recycling/ Zero Waste. This measure includes a suite of strategies, one of which is Composting. Compost operations may adversely affect water quality if waste if discharged to the waters of the State. These impacts can be mitigated by complying with waste discharge requirements.

R. Environmental Justice

In California, environmental justice is defined in state law as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Senate Bill 115, Solis, 1999; California Government Code § 65040.12(c) and defined in statute by SB 115 (Solis, Chapter 690, Statutes 1999).

AB 32 requires that in adopting the greenhouse gas emissions reduction regulations, the ARB must, to the extent feasible:

- Ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities (HSC §38562(b)(2))
- Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions (HSC§38562(b)(4)).
- Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health. (HSC§38562(b)(6)), and
- Maximize additional environmental and economic co-benefits for California and complements the state's efforts to improve air quality (HSC§38501(h)).

Issues relating to meeting environmental justice standards typically can be organized in two categories of potential inequity: "procedural inequity" – referring to the public participation process itself, and "geographical inequity" which refers to undesirable land uses concentrated in certain neighborhoods while benefits are received elsewhere or where "public amenities are concentrated only in certain areas". With regard to public participation, in developing the AB32 Scoping Plan, the ARB conducted extensive and ongoing public workshops with a significant effort included to meet in small-scale community meetings in already-impacted communities throughout the State. Specifically, in designing the Scoping Plan, 5 public workshops were conducted in Los Angeles, San Diego, Fresno, Oakland, and in Sacramento. Five community meetings were coordinated within environmental justice communities including Stockton, Chula Vista, Fresno, and Los Angeles; an additional meeting is planned in Richmond. AB 32 established an Environmental Justice Advisory Committee (EJAC) which has met thirteen times since March 2007 to advise the AB32 Scoping Plan process. Additionally, there have been multiple technical and economic stakeholder meetings, and a public health analysis workshop.

With regard to reviewing the Scoping Plan for geographical inequity, the Scoping Plan is a planning document which provides a broad guide for sectors of the California economy that will fall under greenhouse gas reduction requirements. Considering the programmatic nature of the Scoping Plan, the Plan itself does not

reveal geographical inequities resulting from measures within the Scoping Plan. That said, potential impacts related to implementation of regulations for each sector within the Scoping Plan, as well as for a cap and trade program will need to be analyzed subject to all legal requirements specified in AB32, and as identified by the State of California's General Plan Guidelines, and tested to ensure no geographically-based and/or procedurally-based inequities occur as a result of regulatory adoption.[15]

Further, AB 32 requires that prior to the inclusion of any market-based mechanism, the ARB must, to the extent feasible, "consider the potential for direct, indirect, and cumulative emission impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution" and design its cap and trade program "to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants" and "maximize additional environmental and economic benefits for California" as appropriate (HSC §38570 et seq).

The Scoping Plan is a programmatic approach to multiple regulatory procedures, each subject to the legal requirements laid out within AB32. In accordance with these laws and with respect to the FED, each proposed regulation within the Scoping Plan will have its own public participation process and its own environmental justice analysis. This is primarily due to the fact that the proposed measures within the Scoping Plan are not fully defined. For example, multiple design aspects within a proposed cap and trade program must have defined trading rules and requirements before significant impacts can be evaluated with any certainty. Any direct impacts resulting from adoption and implementation of such a program would be separately evaluated by the appropriate agency through applicable state and local environmental review processes.

Immediately upon Scoping Plan approval, ARB will embark on a series of technical workshops, public meetings, and a citizen advisory process that will thoughtfully explore options to implement the regulatory procedures for measures within the Scoping Plan and for the establishment of a cap and trade system. ARB will ensure that any implementation of regulations in the Scoping Plan, including the cap and trade program, incorporates necessary safeguards against localized impacts into the regulatory process and into program design. Additionally, the regulation would need to remain consistent with associated regulatory requirements and State policies that apply to capped sources and communities where the sources are located.

Within the Scoping Plan, proposed measures that may have potential positive or negative localized social and environmental justice impacts include the following: energy efficiency measures, the Low Carbon Fuel Standard, Goods Movement, and Industrial Measures. The cap-and-trade program linked to WCI may affect the geographical distribution and magnitude of where greenhouse gas emission changes, and the resultant anticipated localized impacts should be considered as a result of

[15] State of California General Plan Guidelines, Chapter 2 pages 20-31

these sectoral changes as the program details become final. During the regulatory phase, the localized impacts for each of these measures will require particular attention and an environmental justice analysis.

S. Impacts to Public Health and Safety

Cumulative Impact. There are no anticipated adverse cumulative public health impacts from the Scoping Plan. Based on estimated changes in emissions of NOx and PM2.5, ARB estimates there will be a net air-quality related public health benefit from the measures recommended in the Scoping Plan, as described in Appendix H. Several of the measures were determined to have a public health or public safety connection aside from NOx or PM2.5, and were evaluated individually.

TRANSPORTATION

(T-1): Pavley I and II-Light-Duty Vehicle Greenhouse Gas Standards. A potential public safety concern is the high voltage wiring within electric-drive vehicles, which must be handled appropriately in the case of an accident. Hydrogen as a vehicle fuel appears to be as safe as gasoline as a vehicle fuel.

(T-3): Regional Transportation-Related Greenhouse Gas Targets. Various studies suggest that community design has a beneficial impact on public health, as increased general fitness and overall well-being reduce many serious health risks. These benefits are further discussed in Appendix H.

(T-9): High Speed Rail. The High Speed Rail PEIR/EIS evaluated the potential for public safety issues related to electromagnetic frequency exposures due to the wireless communication system associated with the project. The evaluation concludes that the potential adverse effects could be avoided or mitigated to a less-than-significant level.

(GB-1): Green Buildings. Buildings can be *designed* to improve indoor air quality, lighting, sound, and odor, and public health through their choice of materials and through ensuring frequent circulation of fresh air. ARB encourages the incorporation of these elements into Green Buildings to leverage their external environmental benefits.

FORESTS

(F-1): Sustainable Forest Target. Wildfires pose direct and indirect risks to public health and safety. Directly, wildfires can kill and can destroy property, and can, under the right meteorological conditions, result in dangerous levels of ozone and PM2.5. Wildfires pose occupational hazards and exposures to fire fighters. Indirectly, deforestation can result in higher loads of organic carbon in raw water sources, which can react to form potential carcinogens in the drinking water treatment process. One goal of this measure is to reduce the magnitude of wildfires in the State.

HIGH GLOBAL WARMING POTENTIAL

(H-4): Limit High GWP Use in Consumer Products. Some types of consumer products containing compressed gases (for example, whipped cream or computer dusters) are used inappropriately to deprive the brain of oxygen and experience a "high." This deprivation of oxygen can be fatal and can also result in long-term brain damage. The measure recommended in this plan will not change the amount of consumer products or reduce the risk of oxygen deprivation when inhaled.

(H-5): High GWP Reductions from Mobile Sources and
(H-6): High GWP Reductions from Stationary Sources. Workplace guidelines exist to minimize the possibility of acute exposures to refrigerants. In addition to its risks as a refrigerant, N_2O is managed to avoid potentially hazardous interactions with other chemicals.[16] As refrigerant use is highly regulated, and the measures recommended in this plan will not significantly change the amount of or way which refrigerants are used. Though any alternatives will be subject to approval under the U.S. EPA's Significant New Alternative Program (SNAP) to ensure their safety, it is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace. Also, certain systems may operate at higher pressures, thus requiring additional technician training to properly and safely serve the equipment.

[16] http://www.osha.gov/SLTC/healthguidelines/nitrousoxide/recognition.html

V. PROJECT ALTERNATIVES

A. Introduction

As discussed at the beginning of this evaluation, ARB meets the criteria for a Certified State Regulatory Program. CEQA requires a certified agency to include one of the following in the document: 1) alternatives to the activity and mitigation measures to avoid or reduce any significant or potentially significant effects that the project might have on the environment; or 2) a statement that the agency review of the project showed that the project would not have any significant or potentially significant effects on the environment, and therefore no alternatives or mitigation measures are proposed to avoid or reduce any significant effects on the environment (CEQA Guidelines §15252).

CEQA also requires an environmental impact report to describe and evaluate the comparative merits of a range of reasonable alternatives to a proposed project that would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project (CEQA Guidelines §15126.6(a)). The range of alternatives required in an EIR is governed by the "rule of reason" that the EIR set forth only those alternatives necessary to permit a reasoned choice. An EIR need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative (CEQA Guidelines §15126.6(f)(3)).

ARB examined five general alternatives to the proposed project. These alternatives fall into three categories:

- **No Project.** This is evaluated as Alternative 1.

- **Adopting a Variation of the Proposed Strategies or Measures.** Under this alternative, ARB would adopt either a subset or a different mix of the proposed measures. This is evaluated as Alternative 2.

- **Adopting a Program Based Primarily on One Type of Strategy.** Under these alternatives, ARB would adopt programs that rely primarily on a cap-and-trade program, primarily on source-specific regulatory requirements or primarily on a carbon fee. These alternatives are evaluated as Alternatives 3, 4, and 5.

Under CEQA, the alternatives are required to feasibly obtain the objectives of the proposed project. For this reason, it is important to note that AB 32 requires ARB to prepare and approve a Scoping Plan for achieving the maximum technologically feasible and cost-effective greenhouse gas emission reductions (HSC §38561(a)). If

the Scoping Plan were not adopted (i.e., the "No Project" alternative) ARB would fail to fulfill the legal mandates specified in AB 32.

B. Alternative 1: No Project

CEQA requires a specific alternative of "No Project" to be evaluated, and this alternative essentially serves as ARB's baseline for analysis. CEQA documents typically assume that the adoption of a "no project" alternative would result in no further action by the project proponent or lead agency. However, this is not true for some of the actions identified in the Scoping Plan. Some of the measures in the Scoping Plan are already underway and would not be expected to change as a result of the Scoping Plan.

A summary of sector-based conditions follows in the event that the "No Project" Alternative is selected. Descriptions of the 2020 "business as usual" (BAU) forecasts for the major sectors of the emissions inventory are provided in the discussion below. ARB staff BAU emissions estimates were derived by projecting emissions from a past baseline year using growth factors specific to each of the different economic sectors. For the purposes of the Scoping Plan, ARB used three-year average emissions, by sector, for 2002-2004 to forecast emissions to 2020. 2004 was the most recent year for which actual data were available. This three-year average of known emissions will dampen unusual variations in any given year that would make the baseline year unrepresentative for forecasting.[17]

It is important to note that the two main drivers of the No Project scenario involve population growth and current laws and regulations. Population growth in California will result in more vehicle miles travelled, more goods movement, greater water and energy demands, and more consumer products. In 2008, ARB adopted and submitted to the U.S. EPA Administrator a State Implementation Plan that provides for implementation, maintenance and enforcement of national ambient air quality standards. The SIP would remain in place even if the Scoping Plan were not adopted.

A sector by sector description of the "No Project" Alternative, or BAU follows:

[17] http://www.arb.ca.gov/cc/inventory/inventory.htm

Role of State and Local Governments

State Government: State government would continue its current practices, policies, investments, and its influence with California local governments and other states. California state government would impact emissions from agricultural activities, forests, water use, resource use, electricity, fleet, buildings, planes, trains, and automobiles. It is comprised of prisons, hospitals, military bases, veterans homes, fairs, and office buildings that it owns and operates. State government also leases hundreds of buildings, vehicles and pieces of equipment, and holds some sway over thousands of companies with whom it does business. State government's contribution to business-as-usual conditions is included in the sectors below.

Local Government: Local governments have authority over how and where business, commercial and residential developments occur in their communities. Recent legislation requires that ARB work with metropolitan planning organizations to set transportation-related greenhouse gas reduction targets that can shift land use patterns, improve transportation, build on successful planning processes that sustainable environmentally sustainable communities. This law is related to but independent of AB 32. Local government's contribution to business-as-usual conditions is included in the sectors below.

Transportation

Petroleum-based fuels supply 96 percent of California's transportation needs and will continue to provide a substantial portion into the future. Greenhouse gas emissions in 2020 from the transportation sector as a whole are expected to increase from current levels to 225.4 million metric tons of carbon dioxide equivalents ($MMTCO_2E$). This forecasted increase is dominated by increases in emissions from on-road transportation, i.e., passenger cars and heavy-duty trucks. To forecast on-road transportation emissions, ARB staff used 2007 fuel sales data obtained from the California Board of Equalization and estimated 2020 emissions based on the growth in projected vehicle miles traveled (VMT) derived from the 2007 Emissions Factor Model (EMFAC2007). This BAU forecast assumes no change in vehicle fleet mix over time. The BAU forecast also assumes no reductions in VMT or airplane traffic due to the High Speed Rail (HSR), although the HSR has completed all of its environmental evaluations (SCH #2001042045) and could proceed independent of AB 32 implementation.

Goods movement activities in California are projected to increase up to 250 percent between 2006 and 2020, as the United States increases its exports and imports in the globalized economy. This increase translates to more ship and truck trips in and around ports, and more truck activity between and at rail yards and distribution centers. Rail trips will probably not increase, as improvements in locomotive efficiencies accommodate larger hauls. Some of this growth may require new

infrastructure to relieve traffic congestion and improve efficiencies, such as port and highway expansions. ARB adopted and is implementing a Goods Movement Emission Reduction Plan to reduce emissions from goods movement activities and address regional ozone and particulate matter standards, as well as impacts on already adversely-impacted communities, which can be located near ports, rail yards, and distribution centers.

CEC's *2007 Integrated Energy Policy Report* indicates that by 2020, at current trends, more than 44 million Californians will consume more than 24 billion gallons of gasoline and diesel fuel each year. Such increased consumption would require major investments in petroleum refinery and delivery infrastructure expansions. Assembly Bill 1007 (Pavley, Chapter 371, Statutes of 2005) directed the California Energy Commission (CEC) and ARB to develop a plan to increase the use of alternative fuels in California, effectively reducing California's demand on refineries. California's refineries also supply other western states, which are currently expected to increase their demands for gasoline and diesel into the future due to population growth. Fuel diversity has also been identified as a major policy objective in the CEC's *2003 Integrated Energy Policy Report* and the Governor's BioEnergy Executive Order S-06-06 and Bioenergy Action Plan.

California's population is continuing to grow at 1.2 percent per year. If the measures in the Scoping Plan are not implemented, land use patterns and decision making will likely continue to foster leap frog development and urban sprawl, which directly relates to a continued increase in VMT, further degradation of air quality, and an increase in detrimental health effects. Most of the gains made by introducing cleaner vehicles and fuels will be eroded unless more efficient methods of urban and community planning, transit choices, and public safety measures are implemented.

Electricity and Natural Gas

Under a business as usual scenario, population growth in California will affect electricity demand in two ways: the number of residents will increase the overall demand for electricity and natural gas, and the location of those residents, primarily in the state's inland areas, will change the pattern of energy use. Trends toward larger homes and increases in electronic equipment will also increase demand. Historically, California's appliance and building efficiency standards were able to hold our per capita electricity and natural gas demands steady, but under a business as usual scenario these programs will not be able to continue this trend through 2020 and new capacity would be needed.[18] As demands increase, older, less efficient and dirtier power plants would be expected to operate more frequently.

[18] CEC, "2007 Integrated Energy Policy Report", CEC-100-2007-008-CMF.

The pattern of energy use is important, because the electrical system is sized to accommodate peak demands. The base of the state's electrical demand is a minimum amount of energy demanded by the state all the time. The peak demand is the difference between this base and the maximum amount of energy needed, usually during periods of extreme weather. Power plants that provide base energy are the most cost-effective, because they are run fairly constantly. "Peaker" power plants, on the other hand, can be run as little as 4 hours a day on a few very hot summer days, and the low duration of operation tends to result in higher co-pollutant emissions than their base counterparts on a per MW basis. Power plants are typically dispatched starting with the most efficient sources, which are generally also those with lowest emissions. Under BAU conditions, many new power plants will need to be built in California to accommodate load growth and to replace the existing fleet of aging power plants that have low efficiencies and relatively high co-pollutant emissions. There are also several coastal plants that could be closed in response to proposed environmental requirements for their once-through cooling systems.[19]

Power plants are typically located close to power recipients, suggesting that new power plants would most likely follow population growth in the state. Repowering old plants or constructing new plants in the South Coast, where the state's greatest demand is located, has been identified as particularly problematic due to the region's air quality constraints.

Along with reliable power plants, important components of a reliable electricity system are distribution, transmission, and availability of fuel supplies. Like power plants, distribution systems are aging, and require substantial infrastructure investments to ensure their continued reliability. The construction of new transmission lines is needed to increase the state's renewable electricity sources to meet the existing regulatory goals of 20 percent. If these goals are not met, the price of electricity could increase as utilities incur financial penalties. These issues have all been identified in the 2007 Integrated Energy Policy Report (2007 IEPR) as high priorities for the state in the near term.

A third challenge is from the effects of climate change such as increasing frequency and magnitude of extreme weather events. This could drastically affect the duration and magnitude of peak demands, increasing reliance on aging power plants. During the summer months, California also imports energy generated by hydropower from the Northwest to meet peak demand. Decreasing snowpack within California and throughout the west is likely to reduce the availability of this clean and relatively inexpensive hydropower source, further exacerbating the problem. In addition, a large number of power plants in California are located along the coast. The potential for sea level rise associated with climate change could impact the operation of those plants.

[19] State Water Resources Control Board, proposed *Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling*, March 2008.

The 2020 business-as-usual greenhouse gas emissions forecast for the electric power sector is 139.2 $MMTCO_2E$. These emissions are the result of in-state power generation plus specified and unspecified imported power. BAU forecasted emissions assume that all growth in electricity demand by 2020 will be met by either unspecified imports or in-state natural gas-fired power plants.

The 2020 BAU forecast for emissions from specified sources of imported electricity (i.e., power received from specific out-of-state power plants) is assumed to decrease resulting from the closure of one coal-fired power plant (Mojave) previously supplying imported electricity. The demand previously served by the closed plant was replaced by in-state natural-gas generation. Based on outputs from the California Energy Commission's (CEC) electricity demand models, in-state electricity generation and specified imports would not meet the State's full electricity demand in 2020. The remaining demand is assumed to be met by unspecified imported electricity (i.e., power received from a mix of power generating sources outside the State).

The Emissions Performance Standard, (EPS) was established by SB 1368 (Perata, Chapter 598, Statutes of 2006), and will effectively reduce emissions from imported, coal-generated electricity. Regulations adopted pursuant to SB 1368 set by the CPUC for investor-owned utilities and by the CEC for publicly-owned utilities prevent all California utilities from entering into long-term contracts that fail to meet an emissions performance standard. As existing agreements expire, coal-intensive electric utilities will see reduced emissions that minimize their need for allowances under cap and trade. Such utilities will need to plan to replace coal-generated electricity with energy efficiency, renewables and less carbon-intensive resources. ARB does not consider the EPS in the forecasted 2020 emissions. This allows the Scoping Plan reductions from increasing renewable power generation to be counted against with the BAU forecasted 2020 emissions without double-counting the reductions.

Electricity and Natural Gas in Residential and Commercial Properties

The Commercial and Residential sector is expected to contribute 46.7 $MMTCO_2E$ or about eight percent of the total statewide greenhouse gas emissions in 2020. Forecasted BAU emissions from the Commercial sector include combustion emissions from natural gas and other fuels (e.g., diesel) used by office buildings and small businesses. Residential emissions result primarily from natural gas combustion used for space heating and for hot water heaters. Growth in emissions from the Commercial and Residential sector is due primarily to the expected increase in population and assumed increased use of natural gas. Emissions from the use of other fuels, such as diesel fuel, are assumed to remain relatively constant over time.

Population growth in California will continue to increase electricity demand. The extent of the increase depends on natural gas used and the location of the users.. Trends towards larger homes and increases in electronic equipment will also increase demand.

According to the Attorney General's website, during 2007 and 2008, an unprecedented number of communities across the state implemented environmentally sensitive, or "green" building requirements in order to increase energy efficiency and decrease greenhouse gas emissions and other environmental impacts within their jurisdictions. In the first half of 2008 alone, nearly a dozen mandatory green building ordinances have taken effect, requiring private developers to utilize and document green building practices used throughout the construction and life of the project. Other California cities, like San Francisco, San Leandro, Santa Rosa, Hayward and Los Altos Hills are currently developing ordinances for enactment in the near future. The experience of these cities has shown that bold, ambitious action to reduce carbon emissions is possible. These efforts have taken place without the Green Building measures being adopted as part of the Scoping Plan, and ARB applauds all the jurisdictions that are moving forward with adopting green building ordinances.

Water

California's water system is stressed today, and will likely be more so in 2020. The California Water Plan Update 2005 presents three potential scenarios for conditions in 2030. All three scenarios indicate a growing demand for water and increasing stresses on a complicated system. The Colorado, Delta, and Klamath water supply systems are experiencing serious conflicts among ecosystem, agricultural, and urban needs, and many infrastructure solutions under discussion today will likely not be in place by 2020.

All sectors will be affected by the changing dynamic in the amounts of water stored in the state's snowpack. Balancing the water needs of the state, the expected increase in water demand for energy production and industrial uses, consumption by an increasing population, increase in demand to grow crops all balanced with maintaining water quality and healthy ecosystems, will become more complex, challenging and expensive.

Water is intricately linked with energy and the State is already experiencing the need to conserve both water and electricity. In California, hydropower provides about 15 percent of the total electricity[20] while approximately 19 percent of the state's electrical demand comes from transporting, treating and using water. California's economy is built upon both reliable and affordable fuels and water. If the State does not implement the water measures identified in this Plan, the already over-allocated

[20] http://www.energyquest.ca.gov/story/chapter12.html

water system will face additional water shortages. Without actions to improve water supplies, water shortages could get worse at rate of approximately two to three percent per year. This rate is likely to be much higher, given the likely impacts that global warming will have on the State's water system. These measures are needed, at a minimum, to meet increasing demand from a growing population.

Green Buildings

Population growth in California will continue to increase electricity demand. Green building measures can help reduce the energy use associated with buildings in California.

There are several policies, codes, and plans in place to increase the environmental efficiency of new and existing commercial, residential, and state buildings by 2020, including the new California Green Building Standards Code adopted by the Building Standards Commission in July 2008. The California Public Utilities Commission (CPUC) also has established "zero net energy" (ZNE) goals for new construction in California. By 2020, the goal is that all new homes will be ZNE. For commercial buildings, the target date is 2030. In the best case, if the state is able to transform new housing and building stock into “net zero energy” stock, and existing buildings are retrofit for greater energy and water efficiency, the demand for water and energy from buildings will be similar to or lower than what it is today. This will depend on both the degree to which new stock is built or existing stock is converted and the degree to which they incorporate environmental efficiency over the next twelve years.

During 2007 and 2008, an unprecedented number of communities across the state implemented environmentally sensitive, or "green" building requirements in order to increase energy efficiency and decrease greenhouse gas emissions and other environmental impacts within their jurisdictions. In the first half of 2008 alone, nearly a dozen mandatory green building ordinances have taken effect, requiring private developers to utilize and document green building practices used throughout the construction and life of the project. Other California cities, like San Francisco, San Leandro, Santa Rosa, Hayward and Los Altos Hills are currently developing ordinances for enactment in the near future. The experience of these cities has shown that bold, ambitious action to reduce carbon emissions is possible and easier than ever before.

Industry

The Industry Sector as defined in the Scoping Plan includes refineries, oil and gas facilities, cement and glass manufacturing, and industrial facilities that employ boilers or general combustion engines. The business-as-usual assumptions for refineries are discussed in the transportation section above. Activity in oil fields in southern California and gas fields in northern California are driven by price and availability,

and could therefore expand in the future if current price trends continue. Off-shore drilling would most likely hold steady, due to the limited yield and potential for severe environmental impacts. While the demand for cement will grow with population growth, most of the demand is likely to be met through out of state production while the current rate of in-state production holds steady. Overall manufacturing is expected to slightly decline, while the commercial sector increases. Manufacturing will likely remain concentrated in the South Coast and Bay Area, with agricultural and food processing concentrated in the San Joaquin Valley.

Emissions for this sector are forecasted to grow to 100.5 $MMTCO_2E$ by 2020, an increase of approximately five percent from the average emissions level of 2002-2004. BAU-forecasted emissions for this sector are variable, but overall are not expected to grow substantially. Most of the growth from this sector comes from the fuel use and process emissions of three industries: cement plants, oil and gas production, and refining. Emissions from the combustion of natural gas are expected to grow for some industries (e.g., cement plants) and decline for others (e.g., food processors). These assumptions of growth and decline in natural gas demand are based on outputs from energy demand modeling conducted by CEC staff for the 2007 IEPR.

Recycling and Waste Management

Currently, California disposes an estimated 42 million tons of waste in landfills each year, of which an estimated 30 percent is compostable organic materials, 22 percent is construction and demolition debris, and 21 percent is paper.[21] Fifty-four percent of California's waste is diverted from landfills and recycled or repurposed. Most of the remainder of California's waste is sent to landfills in the state. In the future, the need for new landfills will be determined by both population growth and by how well the State implements its waste management goals. The CIWMB has a strategic goal of becoming a Zero Waste State. One supporting goal is to halve the volume of organics going to landfills by 2020. These goals will require the development of new facilities to recycle and repurpose waste, but will also reduce the need for new landfill capacity.

Forecasted BAU emissions in 2020 for landfills are 7.7 $MMTCO_2E$. This forecast uses a recognized landfill gas emissions model developed by the Intergovernmental Panel on Climate Change (IPCC) and data from the CIWMB. The forecast reflects assumptions regarding the continued decay of existing waste in landfills and estimates on the amount and character of new waste deposited in landfills through 2020.

[21] From the California Integrated Waste Management Board website: http://www.ciwmb.ca.gov/Climate/ Organics/ default.htm.

Forests

The forest sector is unique to California's greenhouse gas inventory because it combines both positive and negative emissions into a current sink of approximately -5 MMTCO_2E (2002-2004 average). This net number is negative because the gross emission rate from fires, decomposition, harvesting, land conversion, and waste is less than the atmospheric uptake of carbon from forest growth. In addition to being a greenhouse gas sink, forests also provide multiple ecological benefits like habitat, structure, and nutrient cycling, as well as a suite of other human benefits or services such as water storage, soil stability, air and water quality, wood products, and recreation. The BAU inventory shows that forest sector emissions are increasing while forest growth is remaining the same. Two factors addressed in the Scoping Plan which affect forest sector emissions are land conversion and the incidence of wildfires. If this trend continues, emissions will equal uptake by about 2020 meaning that the inventory will increase to zero and this sink will be lost.

As seen in summer 2008, wildfires can significantly impact air quality and threaten public safety. Wildfires in water supply watersheds can also impact drinking water quality for years after they occur. Population growth will increase pressure to develop forest lands and development in close vicinity of forests can further increase risk. Global warming is also likely to increase risks associated with the forest sector through changes to weather patterns which can impact forests both directly and indirectly, by creating hospitable conditions for pests and catastrophic fires.

High Global Warming Potential Gases

Consumer demand, vehicle use patterns, and increased electrical demand due to population growth will increase the amount of high-GWP gases released to the atmosphere. The rates of increase vary by type of activity.

The forecasted BAU 2020 emissions of high-GWP gases are 46.9 MMTCO_2E. High-GWP gases, including sulfur hexafluoride (SF_6) from electric utility applications, substitutes for ozone depleting substances (ODS) (primarily hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)), and other high-GWP gases used in semiconductor manufacturing and other industrial processes are combined under one sector for purposes of the Scoping Plan. The forecast of business-as-usual emissions of high-GWP gases is derived from the U.S. EPA Vintaging Model, which outputs predicted annual consumption and emissions of all high GWP gases based on end-use equipment, the amount of gas required for manufacture and maintenance, and disposal emissions. Emissions of HFCs and PFCs as ODS substitutes occur from their use in refrigeration and air conditioning systems, among other commercial and industrial applications. The high business-as-usual forecasted emissions in 2020 comes about as ODS's are rapidly replaced by ODS substitutes, as more ODS's are phased out. In addition, ARB assumes that the effect of an expansion of the electrical

transmission system infrastructure, combined with the technical improvements to the equipment in the system, will result in no net change in SF_6 emissions in 2020.

Agriculture

The agriculture sector includes emissions from livestock, i.e., digestive processes and manure management; combustion of liquid and gaseous fuels used for irrigation and crop production; emissions from fertilizer use and application of other soil additives; and emissions from agricultural residue burning. By 2020 there is significant potential for continued conversion of farmlands to urban, commercial or industrial development or other uses. The California Department of Food and Agriculture is currently developing a strategic plan for the future of agriculture in California.

Agricultural residue burning and livestock emissions were forecast using ARB's criteria pollutant forecasting approach. Forecasted emissions from the combustion of natural gas were estimated using outputs from the 2007 IEPR developed by CEC. Other agriculture-related emissions were either held constant or extrapolated using historical trends to obtain a 2020 BAU estimate. BAU emissions from the agriculture sector are forecasted to increase about seven percent from current levels to 29.8 $MMTCO_2E$ in 2020, due exclusively to the assumed increase in livestock population. In spite of current measures to preserve farmlands and open space, through Williamson Act contracts, state land purchase, and general plan land zoning, population increases will continue to pressure the conversion of farmlands to urban, commercial and industrial development or other uses.

C. Environmental Impacts of Alternatives 2 through 5

Alternatives 2 through 5 are summarized below. After this summary is a discussion of ARB staff's rationale for choosing, as the preferred alternative, the specific mix of measures identified in the Scoping Plan.

It is important to note that when compared to BAU emissions, Alternatives 2, 3, 4, and 5 (as well as the mix of measures identified in the Scoping Plan) will all result in greenhouse gas emission reductions in California. For any mix of strategies that would succeed in reaching the AB 32 goal, the types of emission reduction activities undertaken will have to be broadly similar. California will need to improve efficiency in all sectors, and move to lower carbon energy resources in all sectors. In essence, each of the alternatives identifies different mechanisms that could be used to accomplish the same basic types of changes. Different approaches could mean more or less reduction activity in any given sector, but the broad impacts would be similar in kind.

For these reasons, we expect that environmental impacts (both positive and adverse) of all the alternatives would be similar to the impacts expected from mix of measures identified the Scoping Plan. While the magnitude of impacts might increase or decrease, it would be speculative to try to estimate the effects at this time, before the details of the specific measures are developed.

D. Alternative 2: Adopting a Variation of the Proposed Strategies or Measures

Instead of adopting all the measures identified in the Scoping Plan, ARB could adopt some of them or a different mix of them. Numerous alternatives exist to adopt various subsets and mixes of the measures identified in the Scoping Plan. It is not possible to examine these many alternatives in detail without engaging in speculation, because measures ultimately adopted by ARB will depend on the information that is learned in the future during the development of each measure.

In general, ARB must achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions, and the measures must fulfill this mandate. In the process of implementing the Scoping Plan, however, the exact mix of measures and the amount of reductions from each is likely to change.
ARB staff recognizes that due to many factors, including information discovered during each measure's development, technology maturity, and implementation challenges, actual reductions from individual measures aimed at achieving the 2020 target may be higher or lower than current estimates. What is actually implemented will be a variation on the specific mix of recommended measures.

As mentioned above, it is important to note that types of emission reduction activities undertaken under any mix of strategies that meet the AB 32 goal will be broadly similar. ARB will need to improve efficiency in all sectors, and move to lower carbon energy resources in all sectors. Different approaches could mean more or less reduction activity in any given sector, but broad impacts would be similar in kind.

E. Alternative 3: Adopt a Program Based Primarily on Cap and Trade for the Sectors Included in the Cap

Instead of pursuing sector-specific regulations, ARB could pursue greenhouse gas reductions from sector in the cap solely through a cap-and-trade program.
"Uncapped" sectors, like high global warming potential gases, would continue to be subject to sector-specific regulations. This alternative would mean that measures in the electricity, natural gas, industry and transportation sectors that are not required under existing law would not be implemented. Such measures include the Low Carbon Fuel Standard, going from 20 percent to 33 percent for the Renewables

Portfolio Standard, increasing combined heat and power, increasing the targets for energy efficiency, and the industrial measures. Instead of implementing these specific measures, an equivalent amount of emission reductions would be achieved through the cap-and-trade program.

Under this alternative, similar types of emission reduction efforts as are currently proposed in the Scoping Plan are likely to be undertaken, but ARB cannot predict in which sectors and in what geographic locations these reductions would occur. For California to meet the AB 32 target for greenhouse gas emission reductions by 2020, significant activities would be needed to increase the efficiency with which Californians use transportation fuels, electricity and natural gas, and additional renewable resources would be needed as part of the transportation fuel mix and electricity supply. While the particular mix of reductions would be left to the marketplace, the general types of activities (e.g. new biofuel production facilities, and new renewable electricity generation facilities) would be same.

Furthermore, if the cap-and-trade program is a regional program as currently proposed, the relative cost of reductions in California compared to the rest of the region could increase or decrease reductions in California as compared to a California-only program. To the extent out-of-state offsets are allowed, this could mean less activity in California as compared to another program that did not allow out-of-state offsets.

F. Alternative 4: Adopt a Program Based Primarily on Source-Specific Regulatory Requirements with No Cap and Trade Component

Instead of pursuing a cap-and-trade program, ARB could pursue source-specific regulations for all sectors. This alternative would mean that additional greenhouse gas emission reductions would need to be required through more aggressive implementation of the measures already recommended or implementation of additional measures in order to meet the 2020 target.

As with the recommendations in the Scoping Plan, measures ultimately adopted by ARB and other state agencies in a program based solely on source-specific regulatory requirements would depend on the information that is learned in the future during the regulatory development processes. Because of that, ARB cannot predict in which sectors and what geographic locations the measures would occur. For California to meet the AB 32 target for greenhouse gas emission reductions by 2020, significant activities would be needed to increase the efficiency with which Californians use transportation fuels, electricity and natural gas, and additional renewable resources would be needed as part of the transportation fuel mix and electricity supply.

As discussed previously, we expect that environmental impacts (both positive and adverse) would be similar at a programmatic level to impacts expected from the Scoping Plan. It would be speculative to attempt to estimate different mixes in more detail at this stage of the process. While the environmental impacts from implementing this alternative would be similar to those from implementing the Scoping Plan, ARB has determined that the combination of a cap-and-trade program and complementary measures is the preferred alternative, as discussed in Chapter II of the Scoping Plan. The development of a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system will lead to prices on greenhouse gas emissions that would spur reductions in greenhouse gases throughout the California economy, through application of existing technologies and through the creation of new technological and organizational options. This will help ensure that the greenhouse gas emission reductions are achieved in the most cost-effective manner. Working with California's regional partners in WCI will also result in greater emission reductions from the program overall than would be possible from California acting alone. In addition, the cap-and-trade program provides a firm cap on 85 percent of the state's greenhouse gas emissions, increasing California's certainty in meeting the 2020 target, and provides a robust mechanism to achieve the additional reductions needed by 2050.

G. Alternative 5: Adopt a Program Based Primarily on a Carbon Fee

Instead of the proposed mix of measures and strategies in the Scoping Plan, ARB could replace the cap-and-trade program in the recommendation with a carbon fee. A carbon fee, like a cap-and-trade program, is a way to price carbon. Because a carbon fee and a cap-and-trade program both force covered sources to either reduce emissions or pay for those emissions, the economic incentives under the two programs are similar. For this reason, ARB staff would expect to see similar types of emission reduction efforts undertaken under a carbon fee-based program as in one relying on a cap-and-trade program, but cannot predict in which sectors and in what geographic locations the reductions would occur.

While a carbon fee and a cap-and-trade program provide very similar economic incentives to those covered, a carbon fee does not provide certainty in terms of the amount of emission reductions that will be achieved. The cap-and-trade program, on the other hand, which provides a firm cap on 85 percent of the state's greenhouse gas emissions, increases California's certainty in meeting the 2020 target and also provides a robust mechanism to achieve the additional reductions needed by 2050.

H. Rationale for Selecting as the Preferred Alternative the Mix of Measures Identified in the Scoping Plan

As discussed in Chapter II of the Scoping Plan, ARB staff believes that the combination of a cap-and-trade program and complementary measures is the preferred alternative. Achieving the emission reductions goals for AB 32 under any strategy or mix of measures will require fundamental changes to lower the carbon-intensity of the resources used and to increase the efficiency of energy use throughout California's economy. In developing the Plan, ARB has considered a wide range of potential measures for reducing greenhouse gas emissions from sources across California's economy.

As can be seen in Table 1, projected business-as-usual emissions in 2020 are spread throughout the major sectors of California's economy, and no one sector has a sufficiently large share to become the primary focus for emission reductions if California is to achieve its overall goal under AB 32 of a 30 percent greenhouse gas reductions in 2020. California will need to see significant reductions in the transportation, electricity, commercial and residential and industrial sectors, as well as contributing reductions from the other sectors of the economy. Because energy is required to transport and treat water, strategies in the Water sector will help reduce energy use and associated greenhouse gases. For the Recycling and Waste sector, emission reductions reach beyond the emissions from landfills shown in Table 1. For example, reducing the generation of waste would reduce the need to transport the waste to landfills – lowering transportation emissions and possibly, landfill methane emissions. Increased recycling or re-use would reduce the carbon emissions embedded in products – it take less energy to make a soda can from recycled aluminum than from virgin feedstock. While the particular mix of reductions and balance across sectors could vary based on different policy approaches, achieving the needed reductions will require some degree of action to decrease the carbon content of fuels used for transportation and electricity generation, and an increase in the efficiency of energy use across all sectors of the economy. For this reason, under any mix of strategies that meets the AB 32 goals, the types of actual emission reduction activities undertaken will be broadly similar. Different approaches could mean more or less reduction activity in any given sector, but the broad impacts would be similar in kind.

Table 1: Projected 2020 Business-as-Usual Emissions

Sector	$MMTCO_2E$	Percent
Transportation	225.4	37.8%
Electricity	139.2	23.4%
Commercial and Residential Combustion	46.7	7.8%
Industry	100.5	16.9%
Recycling and Waste	7.7	1.3%
High GWP	46.9	7.9%
Agriculture	29.8	5.0%
Forest Net Emissions	0.0	0.0%
Emissions Total	**596**	

Because of the diversity of emission sources, achieving the goals of AB 32 in a cost-effective manner will require a wide range of approaches that will provide reductions from every part of California's economy. The recommended measures were developed to reduce greenhouse gas emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving our natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put the state on a path to meet the long-term 2050 goal of reducing California's greenhouse gas emissions to 80 percent below 1990 levels. This trajectory is consistent with the reductions that are needed globally to help stabilize the climate. While the scale of this effort is considerable, our experience with cultural and technological changes makes California well-equipped to handle this challenge.

ARB evaluated a comprehensive array of approaches and tools to achieve these emission reductions. As discussed at the start of Chapter II in the Scoping Plan, reducing greenhouse gas emissions from the wide variety of sources can best be accomplished though a cap-and-trade program along with a mix of complementary strategies that combine market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs.[22] ARB will monitor implementation of these measures to ensure that the State meets the 2020 limit on greenhouse gas emissions.

The development of a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system is a central feature of the overall recommendation. This program will lead to prices on greenhouse gas emissions, prices that would spur reductions in greenhouse gases throughout the California economy, through application of existing technologies and through the creation of new technological and organizational options. This will help

[22] Chapter II, Recommended Actions, of the Scoping Plan is incorporated by reference.

ensure that the greenhouse gas emission reductions are achieved in the most cost-effective manner. Working with California's regional partners in WCI will also result in greater emission reductions from the program overall than would be possible from California acting alone.

ARB staff also believes that it is critically important to include complementary measures directed at emission sources that are included in the cap-and-trade program in order to spur innovation and overcome traditional market barriers. These complementary measures in the capped sectors are designed to achieve cost-effective emissions reductions while accelerating the necessary transition to the low-carbon economy required to meet the 2050 target.

Each of the complementary measures will help to position the California economy for the future by reducing the greenhouse gas intensity of products, processes, and activities. When combined with the absolute and declining emissions limit of the cap-and-trade program, these policies ensure that we cost-effectively achieve our greenhouse gas emissions goals and set ourselves on a path towards a clean low carbon future.

VI. CONCLUSION

In order to meet the requirements of AB 32 it will be necessary to adopt measures that will achieve the maximum technologically feasible and cost effective emission reductions. ARB staff has chosen as their preferred alternative the specific measures identified in the Scoping Plan. Staff's rationale for this choice is set forth in Chapter 2 of the Scoping Plan and in Appendix J to the Plan (see Chapter V, Project Alternatives, of Appendix J: California Environmental Quality Act Functional Equivalent Document).

The Scoping Plan contains a description of each measure identified in the Plan. However, the final form and specific provisions of each measure will depend on information learned in the future during the process of developing each measure. A more detailed environmental analysis will be prepared for each measure at the time it is developed and adopted.

VII. IMPACTS OF INDIVIDUAL PROPOSED MEASURES

The measures in the Scoping Plan will help make progress toward California's goals of reducing greenhouse gas emissions and of healthy air for all Californians. The following table lists each of the measures, any potentially significant environmental impacts and possible mitigation strategies.

Potential Adverse Environmental Impacts of the Scoping Plan

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Scoping Plan	**Air Quality –** Reduced reliance on out-of-state coal generation could result in increases in in-state natural gas generation, though specific recommended measures will decrease demand for electricity and increase the share of renewable energy resources. It is not clear whether this will result in a net increase in natural gas use for electric generation in California. A potential result of increased in-state electrical generation could be localized air quality impacts.	California air quality regulatory programs at the federal, state, and local levels address individual source emissions from a regional and localized perspective.
	Energy Demand – Reduced reliance on out-of-state coal generation could result in increases in in-state natural gas generation, though specific recommended measures will decrease demand for electricity and others will increase the share of renewable energy resources. It is not clear whether	The cumulative impact of implementation will be to decrease California's total demand for electricity and natural gas.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	this will result in a net increase in natural gas use for electric generation within California.	
California Cap-and-Trade Program linked to Western Climate Initiative Partner Jurisdictions (Capped sources include Electricity and Natural Gas, Transportation Fuels and Large Industrial Sources)	**Air Quality** – No adverse impacts are expected. Some individuals have raised concerns about localized impacts as a result of the trading component of the cap and trade program. **Energy Demand** – there may be a shift from combustion engines to electric engines, resulting in an increase in demand.	Before including a market mechanism in any regulation, ARB must, to the extent feasible, "consider the potential for direct, indirect, and localized emission impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution." It is not possible to definitively determine the level of significance of this potential impact at this time.
Transportation		
(T-1) Pavley I and II – Light –Duty Vehicle Greenhouse Gas Standards	No adverse environmental impacts anticipated.	None necessary.
(T-2) Low Carbon Fuel Standard – includes facilities for ethanol and biodiesel production; use of hydrogen and electricity as alternative fuels.	**Aesthetics** – This measure is undergoing regulatory development. **Air Quality** - Ethanol production requires the use of thermal and electrical power. Process steam production is the primary source of criteria pollutant emissions. The largest sources of PM_{10} are	Any impacts would be assessed on a location and project-specific basis. Procure VOC emissions offsets. Employ best available control technologies which may include Ultra-Low NOx burners on steam boilers, baghouses for PM control, and wet scrubbers to control VOC emissions.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	associated with grain handling, and the largest sources of VOCs are associated with the fermentation, distillation, storage, and loading of the ethanol produced.	Site facilities near truck or rail terminals, consider proximity to feedstocks or users of ethanol products to minimize transport emissions.
	Hydrogen can be a low carbon fuel. Can be used in either modified internal combustion engines or in fuel cells. Combusting hydrogen produces heat, water, and may produce minor NOx emissions.	Should be quantified and measures to mitigate identified in regulatory process.
	Agricultural Resources - Siting of new stationary sources, such as ethanol facilities, or facilities that convert biomass to fuel may convert prime farmland to other uses – the degree of which would be determined locally, and may conflict with an existing Williamson Act contract.	Avoid siting on prime agricultural lands, lands under Williamson Act contract, support of the California Farmland Conservancy Program. Such facilities would require a local approval of conditional use permits, local air permits, and other permits and would be subject project-specific compliance with CEQA.
	Biological Resources – When converting natural lands, there may be adverse impacts to terrestrial, riparian or aquatic habitat, natural	Project-specific CEQA compliance will be necessary.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	communities or to an species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations or by CDFG, USFWS or in § 404 of the Clean Water Act.	
	Interference with movement in corridors.	Project-specific CEQA compliance will be necessary.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
	Energy Demand - Future ethanol production facilities in California will likely use natural gas to produce steam and purchase required electricity from a utility.	Employ efficiency and control technologies at existing facilities.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	Hazards and Hazardous Materials – Some of the pathways may generate waste that may contain hazardous materials	Recycle, reuse or reprocess wastes. Wastes that cannot be recycled, reused or reprocessed must be disposed of appropriately.
	Land Use and Planning – Conversion of crops from food and fiber to fuel crops may conflict with Williamson Act contract.	Check with County to ensure conformity with Contract, file for nonrenewal if nonconforming.
	Water Resources **Water Quality** – chemicals and fertilizers used on crops can end up in surface or ground waters, affecting water quality.	Should be discussed and analyzed in the LCFS regulatory development process.
	There may be potential adverse impact to water quality from formulation of low-carbon fuels in the event of spills	Employment of appropriate spill prevention and spill abatement protocols.
(T-3) Regional Transportation-Related Greenhouse Gas Reduction Targets	**Land Use Policies** - May conflict with existing land use policies in some regions of the State	Any land use policy conflicts will be resolved at regional and local levels in a collaborative process.
Congestion Pricing, Indirect Source Rule,	Congestion Pricing – May increase vehicle use on off-hours but would result in no net increase in	Separate environmental evaluation needed.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Education and outreach efforts, and Pay as You Drive Insurance support to this measure	emissions. Indirect Source Rule for New Development – requires separate environmental evaluation. Education – no adverse impacts anticipated. Pay as You Drive – Dept. of Insurance is pursuing.	 Separate evaluation needed to adopt regulations. None necessary.
(T-4) Vehicle Efficiency Measures (tire inflation, use of low friction oils, cool paints)	No adverse environmental impacts anticipated, but further analysis will be completed to verify	None necessary.
(T-5) Ship Electrification at Ports	**Air Quality** – Indirect impacts from criteria pollutant emissions associated with incremental electricity generation at power plants **Energy Demand** - May increase energy demand	These emissions are significantly less than emissions generated by ship engines. Environmental evaluation completed as part of regulation. Employ off-peak charging
(T-6) Goods Movement VSR – exploring the requirement to reduce	 No adverse environmental impact anticipated, but will need additional	 Conceptual at this time, not quantified.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
speed	analysis.	
Cleaner ships – Design and fuel efficiency strategies	Analyzed in 2007 SIP FED	No additional analysis necessary.
Port trucks, drayage	Analyzed in separate FED	Adopted.
Commercial Harbor Craft – voluntary action to use alternative anti-fouling agent	**Hazards and Hazardous Materials** - Anti-fouling agents to improve hull smoothness may contain copper. This measure encourages the use of alternative agents with no copper. Disposal of residual copper-containing agents may have an adverse impact.	Encourage non-toxic anti-fouling product use and education of owners/operators on the toxicity of copper to reduce use and improper disposal of these chemicals.
Cargo handling	No adverse environmental impact anticipated, but additional analysis will verify	May require further analysis. .
Transport Refrigeration Units (TRU)	**Energy Demand** -TRUs may increase energy demand by electrification	Employ off-peak charging to balance electrical load.
(T-7) Heavy Duty Vehicle Greenhouse Gas Emission Reduction – Aerodynamic Efficiency	Regulation currently being developed in separate evaluation in regulation FED	

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
(T-8) Medium and Heavy-Duty Vehicle Hybridization	No adverse impacts anticipated with efficiency measures, however some technologies are in research and development phase. Further evaluation will verify.	None necessary at this time.
(T-9) High Speed Rail	Impact analysis incorporated by reference, SCH# 2001042045, Potential and cumulative impacts include aesthetics, displacement of commercial and residential properties, disproportionate impacts to minority and low-income populations, community and neighborhood disruption, increased noise and electromagnetic interference along rail corridors, land use policies, traffic impacts associated with stations, effects to historic properties or archaeological sites, impacts to parks and recreation resources, exposure to seismic and flood hazards, water resources, wetlands and sensitive biological species and habitat, land use compatibility, energy use and impacts to agricultural resources.	Programmatic EIR/S was prepared in 2001, followed by project environmental documents. Mitigation measures incorporated by reference.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Electricity and Natural Gas		
(E-1 and CR-1) Energy Efficiency	**Hazards and Hazardous Materials** - Efficiency Standards may occasionally result in the use of new or new versions of products that contain hazardous materials and require special recycling or disposal.	Compliance with applicable hazardous materials recycling and disposal laws. Disposal of hazardous waste would occur at an appropriated permitted disposal facility.
(E-2) Increasing Combined Heat and Power	**Air Quality** –No adverse air quality impacts are anticipated, unless individual CHP units are installed in a way that is not conforming to the measure design.	Use of BACT. These units are permitted through the Air Districts. Location and project-specific CEQA analysis may be required.
(E-3) Renewables Portfolio Standard	**Aesthetics** - siting and construction of wind or solar farms that would support the expansion of the Renewables Portfolio Standard (RPS) may affect viewsheds. **Agricultural Resources** - Siting of new utility scale facilities and arrays may convert prime farmland to other uses – the degree of which would be determined locally, and may conflict with an existing Williamson Act contract.	Careful design and siting of these facilities will avoid impacts, consistent with available CEC and Department of Fish and Game (DFG) guidance documents and siting requirements of federal agencies. Project- specific analysis would be necessary. Avoid siting on prime agricultural lands, lands under Williamson Act contract. If unavoidable, support of the California Farmland Conservancy Program. Such facilities would require a local approval of conditional use permits, and other permits and would be subject project-specific compliance with CEQA.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	Air Quality – Biomass facilities siting and operations may cause an increase in nitrogen oxide, sulfur dioxide, particulate matter (PM_{10} and 2.5).	Use of BACT, such as catalytic converters and filtration. Location and project specific impact analysis will be necessary.
	Biological Resources - Any utility scale facility may require a relatively large area if it is to be used to generate electricity at a commercial scale, and large arrays of solar collector may interfere with natural sunlight, rainfall, drainage which could have a variety of effects on plants and animals. Solar arrays may also create avian perching opportunities that could affect both bird and prey populations. A wind farm may present a potential risk to migrating birds if the facility is sited in a migratory flyway.	Location-specific impact analysis will be necessary. Careful design and siting of wind farms, turbines and infrastructure would minimize the risk for bird strikes. Advances in turbine and wind farm design have resulted in fewer, more powerful turbines and better protection for birds. Use of guidelines by CEC and DFG.
	A solar thermal plant requires around 50 times more land than combined cycle natural gas fueled power plant per MW. Construction activities associate with solar	Specific impacts depend on biological characteristics of the land being developed. Sensitive populations and habitat should be avoided.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	thermal plants disturb the land, and fencing can interfere with wildlife corridors.	
	Nitrogen dioxide deposition from cooling towers at solar thermal plants and new geothermal projects may degrade vegetation.	Use of BACT. Provision of habitat compensation, revegetation.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
	Hazards and Hazardous Materials – Municipal solid waste may contain hazardous materials, which could result in solid and gaseous hazardous by-products.	Ash can be recycled or shipped to landfills permitted to accept such waste, and hazardous materials should be diverted prior to combustion.
	Land Use and Planning – Siting of new utility scale facilities and arrays	Avoidance would be most appropriate mitigation. If land is under easement, conditions must allow use. Such

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	may conflict with an existing Williamson Act contract, or lands under easement.	facilities would require a local approval of conditional use permits, and other permits and would be subject project-specific compliance with CEQA.
	Conversion of crops from food and fiber to fuel crops may conflict with existing Williamson Act contract.	Check with County to ensure consistency with Contract.
	It is foreseeable that additional transmission infrastructure will be necessary to help support the RPS requirements to deliver renewable power to consumers.	Siting of transmission facilities is subject to project specific CEQA analysis by the CPUC.
	Noise – Powerplants and wind power installations may increase ambient noise levels	General Plan Noise Elements and ordinances identify appropriate local noise levels and accepted mitigation measures such as mufflers, limited hours of operations and installation of sound barriers.
	Recreation (see Aesthetics)	USDI Bureau of Land Management is preparing an environmental impact statement (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008) that precludes (as mitigation) the siting of solar arrays from lands within the National Landscape Conservation System, such as National Conservation Areas, National Monuments, Wilderness Areas, Wilderness Study Areas, Wild and

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
		Scenic Rivers and National Historic and Scenic Trails, and lands that have been identified as environmentally sensitive.
(E-4) Million Solar Roofs	**Aesthetics -** Roof top solar panels and solar water heaters may adversely affect a neighbor's quality of rooftop views, however, this is a subjective value. These measures may limit where trees may be planted in order to preserve solar access. **Hazards and Hazardous Materials** – solar panels may leak if mishandled and broken. Photovoltaic panels may contain hazardous materials, and although they are sealed under normal operating conditions, there is the potential for environmental contamination if they were damaged or improperly disposed upon decommissioning. Concentrating solar power system may employ liquids such as oils or molten salts that may be hazardous and present	The significance to aesthetic values would be location specific. Proper handling and operation and good maintenance practices can be used to minimize impacts from hazardous materials (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008).

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	spill risks. Various fluids commonly used in most industrial facilities, such as hydraulic fluids, coolants, and lubricants and may present a spill related risk.	
Green Buildings		
(GB-1) Green Buildings (Also includes Greening Public Schools, New Residential and Commercial Construction, and Existing Homes and Commercial Buildings)	No adverse environmental impacts anticipated, further analysis would verify	None necessary.
Water		
(W-1) Water Use Efficiency	Ongoing program administered by various state agencies.	None necessary.
(W-2) Water Recycling	**Air Quality** - Installation of water recycling infrastructure would require construction activities, potentially generating typical short-term construction impacts such as dust generation, equipment emissions and objectionable odors. **Biological Resources** – Water recycling has the potential to reduce wastewater discharges, potentially	Local jurisdictions and Air Pollution Control Districts typically require measures to mitigate construction impacts such as preparation of grading plans, dust minimization, minimizing idling of equipment and restriction of hours of operation. Site specific field survey and mitigation may be warranted, and project-level CEQA compliance would be accomplished by appropriate lead agencies as individual

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	modifying downstream environments and potentially impacting protected habitats and /or species. Project implementation has the potential to adversely impact biological resources located on project sites, along pipeline corridors and in proximity to construction zones.	projects are considered.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
	Energy Demand – Water recycling could increase the amount of energy used at local wastewater treatment facilities.	Wherever possible, water recycling would be performed during off-peak periods.
	Land Use and Planning – Projects may conflict with habitat	

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	conservation plan or natural community conservation plan.	
	Population and Housing – The availability of recycled water may represent an additional water supply that may foster community growth.	Site specific, project-level CEQA compliance would be accomplished by appropriate lead agencies.
	Water Resources **Water Quality** – Water recycling reduces the quantity of water entering into downstream flows, water table recharge, and infiltration. If wastewater is relied upon for dilution, this reduction could contribute to higher concentrations of contaminants in downstream waters and/or in water tables.	Availability of water supply created by recycling may be considered during General Plan updates and development proposals. Project-level CEQA evaluation would be necessary. This additional water supply is not considered an adverse impact. All water recycling facilities must be permitted and operated in accordance with the requirements of the Water Boards and the Department of Public Health. Project level CEQA compliance would be accomplished by appropriate lead agencies on a project-level basis.
(W-3) Water System Energy Efficiency	**Agricultural, Biological Resources** - New support facilities may convert or disturb agricultural or natural lands.	Project-specific analysis would be necessary.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	departments to ensure that potential impacts to cultural resources would be minimized or avoided.
(W-4) Reuse Urban Runoff	**Air Quality –** Construction of water capture and storage facilities would produce short-term construction impacts **Biological Resources** – Construction has the potential to impact sensitive species that exist on project sites. **Cultural Resources** – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Similar mitigations to W-2. Project-specific evaluations would be necessary and CEQA compliance would be performed by the appropriate lead agencies. Project-specific analysis would be necessary. Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
(W-5) Increase Renewable	**Agricultural Resources –** New	Project-specific analysis would be necessary for new

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Energy Production	support facilities may convert or disturb agricultural lands	facilities.
	Air Quality – Construction of new facilities would produce short term construction impacts.	Compliance with Authority to Construct permit.
	Biological Resources – Construction has the potential to impact sensitive species that exist on project sites.	Project-specific analysis necessary.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
(W-6) Public Goods Charge for Water	No direct adverse environmental impacts are anticipated, as this measure is a potential funding source.	None necessary.
Industry		
(I-1) Energy Efficiency and	Audits would have no adverse	None necessary.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Co-Benefits Audits for Large Industrial Sources	effects at this time; however, results of audit will determine whether any further actions are necessary.	
(I-2) Oil and Gas Extraction GHG Emissions Reduction – Best Management Practices and technologies to reduce fugitive emissions from venting and leaks from wells, process equipment, separation and storage. Increase compressor capacity - Remove existing regulatory fugitive methane exemptions	No adverse environmental impact anticipated, but additional analysis will verify	Separate environmental evaluation will be conducted during regulatory development.
(I-3) GHG Leak Reduction from Oil and Gas Transmission- Best Management Practices and technologies to reduce fugitive emissions from venting and leaks along natural gas pipelines practices	No adverse environmental impact anticipated, but additional analysis will verify	Separate environmental evaluation will be conducted during regulatory development.
(I-4) Refinery Flare	No adverse environmental impact	Separate environmental evaluation will be conducted

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
Recovery System Improvement	anticipated, but additional analysis will verify	during regulatory development.
(I-5) Removal of Methane Exemption from Existing Refinery Regulations	No adverse environmental impact anticipated, but additional analysis will verify	Separate environmental evaluation will be conducted during regulatory development.
Recycling and Waste Management		
(RW-1) Landfill Methane Control	**Air Quality** – Installation of control devices such as flares and energy recovery systems may slightly increase NOx and CO. **Water Resources -** NOx may be scrubbed out of the air and deposited into open water, adversely impacting water quality.	Include NOx and CO in air district's emission inventory. Obtain offsets if landfill gas to energy project. Gas collection systems with flares or other combustion devices are currently the best means to reduce methane. Not quantified at this time. Use of BACT, collection systems would reduce impact.
(RW-2) Additional Reductions in Landfill Methane: Increasing the Efficiency of Landfill Methane Capture	No adverse environmental impact – preparation of a Best Practices Guidance document.	None necessary.
(RW-3) High Recycling/ Zero Waste	**Air Quality** – Composting facilities may emit VOCs and NOx, which are criteria pollutants that contribute to ozone formation.	Site- and project-specific analysis necessary for new facilities. Compliance with Permit to Construct from air district. Use of BACT. Application of a finished compost blanket would reduce VOC emissions for compost

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	Anaerobic digesters may emit air pollutants **Water Resources** – Compost operations may adversely impact water quality if waste is discharged to the waters of the State	operations Site- and project-specific analysis necessary for new facilities. Compliance with Permit to Construct from air district. Use of BACT. Compliance with waste discharge requirements.
Forests		
(F-1) Sustainable Forest Target	No significant adverse environmental impacts identified.	Project – level compliance with CEQA or NEPA would be accomplished by appropriate lead agencies.
Implementing Strategies: Forest Conservation, Forest Management, Afforestation/ Reforestation, Urban Forestry, and Fuels Management (Under Evaluation)	No significant adverse environmental impacts identified at this time.	Project – level compliance with CEQA or NEPA would be accomplished by appropriate lead agencies. Each of the strategies that have ground disturbing activities is an independent action and must be considered as such. Some activities will meet the definition of a "project" under CEQA, while others will not be subject to CEQA. Projects taking place on federal lands are subject to NEPA.
High GWP		
(H-1) Motor Vehicle Air Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing	No adverse environmental impact identified at this time.	Regulation to be developed. Separate environmental evaluation to be prepared.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
(H-2) SF_6 Limits in Non-Utility and Non-Semiconductor Applications	**Hazards and Hazardous Materials** – If N_2O were used in place of SF_6 for fume hood tests, a potential exposure could occur if N2O was accidentally released. Impacts to vulnerable populations should be considered. **Energy Demand** – SF6 tracer tests fro fume hoods are required by CAL/OSHA with a specific energy efficient technology. If ARB's regulation did not allow this test, some energy conservation efforts for fume hood may not take place.	Ensure proper ventilation at exhaust stacks and ensure only verifiers are in the testing room. An exemption for this use or a change in the required test/standard would eliminate any impact to energy conservation efforts.
(H-3) High GWP Reduction in Semiconductor Manufacturing	**Energy Demand** – Facilities operate continuously. Compliance achieved with additional abatement equipment could increase peak and off-peak natural gas and /or electricity use as thermal destruction of emissions requires high temperatures.	Purchases of highly energy efficient abatement equipment, purchases of catalytic destruction systems which operate at lower temperatures.
(H-4) Limit High GWP Use in Consumer Products Pressurized Gas Duster Regulation	**Air Quality** - Hydrocarbon propellants (butane, propane, isobutane) may have lower GWPs, but may contribute to the formation of ground-level ozone.	ARB to further evaluate employment of reformulation options.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
(H-5) High GWP Reductions from Mobile Sources	No adverse environmental impacts known at this time, however, any alternatives will be subject to approval under U.S. EPA's SNAP to ensure their safety. **Pubic Health and Safety -** It is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace.	Separate environmental evaluation will be prepared when regulation is developed. Additional technician training.
(H-6) High GWP Reductions from Stationary Sources	**Air Quality –** Potential criteria and toxic pollutant emissions from recovered foams if combusted. Though any alternatives will be subject to approval under U.S. EPA's SNAP to ensure their safety, it is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace. **Energy Demand –** Facilities operate continuously. Compliance achieved with additional abatement equipment could increase peak and off-peak natural gas and /or electricity use as	Separate environmental evaluation will be prepared when regulation is developed. Purchase and employment of highly energy efficient abatement equipment, and catalytic destruction systems which operate at lower temperatures.

Measure	Potential Adverse Environmental Impacts	Potential Mitigation Measures
	thermal destruction of emissions requires high temperatures.	
(H-7) Mitigation Fee on High GWP Gases	No adverse environmental impact anticipated.	None necessary.
Agriculture		
(A-1) Methane Capture at Large Dairies	**Air Quality** – The combustion of biogas in an engine to generate electricity can emit NOx. **Agricultural Resources** – The siting of manure digesters may not be compatible with existing Williamson Act contracts. **Biological Resources** – construction activities of digester facility may impact biological or resources.	Controls can reduce NOx in exhaust gasses, but types and sizes of engines typically used in conjunction with a dairy digester may be unavailable, or able to meet air district NOx requirements. Use of BACT. Check with city or county to ensure compatibility. Digesters will require CEQA compliance to obtain an "Authority to Construct" permit from the air district. Site specific analysis is necessary to determine whether an impact would result.
Fertilizer Use Efficiency	No adverse environmental impact anticipated	None necessary.
Efficiency Improvements	No adverse environmental impact anticipated	None necessary.

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Appendix 5.7C

Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document

California Environmental Protection Agency
Air Resources Board
August 19, 2011

Attachment D

Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document

California Environmental Protection Agency
AIR RESOURCES BOARD

Released August 19, 2011

considered at the

August 24, 2011 Board Hearing

Modified Text (Clean Copy)

PREFACE

The Air Resources Board (ARB) released a draft Supplement to the AB 32 Scoping Plan Functional Equivalent Document (Supplement) on June 13, 2011, for a 45-day public review and comment period that concluded on July 28, 2011. A total of 109 comment letters were received during the public review period, as well as a number of oral comments from a workshop meeting that was held on July 8, 2011.

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1.0 INTRODUCTION AND BACKGROUND

This document is a Supplement to the AB 32 Scoping Plan Functional Equivalent Document (FED) that was included as Appendix J (Volume III) to the AB 32 Scoping Plan document (ARB 2009) prepared in accordance with the California Environmental Quality Act (CEQA) and the Air Resources Board's (ARB or Board) certified regulatory program (title 17, California Code of Regulations (CCR) sections 60005-60008). In 2008, ARB, acting as the lead agency, prepared a FED for the AB 32 Scoping Plan (2008 Scoping Plan). The 2008 Scoping Plan outlines the State's strategy to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020, as required by the Global Warming Solutions Act of 2006 (AB 32; Núñez, Chapter 488, Statutes of 2006). A "scoping plan" is required by one provision of AB 32 (Health and Safety Code (HSC) section 38561), and ARB's adoption of GHG reduction measures is authorized under a separate provision (HSC section 38562). It is not required that a particular measure be encompassed in a scoping plan in order for ARB to pursue such a measure as a proposed regulation.

In this FED Supplement, "2008 Scoping Plan" refers to the plan considered by the Board in December 2008, with final adoption May 11, 2009 (ARB 2009), and "Proposed Scoping Plan" refers to the plan being brought back to the Board for reconsideration along with this Supplement. (See Section 1.1 below for a description of the anticipated process for environmental review and Board action.)

The 2008 Scoping Plan considered a range of GHG emission reduction measures, including direct regulations, Alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, a market-based cap-and-trade system, and a fee regulation to fund the program. A draft of the 2008 Scoping Plan was released for public review and comment on June 26, 2008, followed by workshops in July and August 2008. On October 15, 2008, the 2008 Scoping Plan was released for a 45 day public review and comment period along with a FED that analyzed the potentially significant environmental impacts that could result from implementing the measures considered in the plan. The FED included an analysis of a range of five alternatives to the proposed 2008 Scoping Plan, including: a "no project" alternative, a plan relying primarily on a cap-and-trade program for the sectors included in a cap, a plan relying more on source-specific regulatory requirements with no cap-and-trade component, a plan relying on a carbon fee or tax, and a plan relying on a variation of proposed strategies and measures. Following the public review and comment period, the 2008 Scoping Plan and the FED were considered by the Board at a December 11, 2008 public hearing, and were subsequently finally approved by the Board's Executive Officer on May 11, 2009.

As discussed in the next section, subsequent events have caused ARB to create a supplement to the FED and to schedule a Board hearing in order to facilitate the Board's reconsideration of its previous decision, based on an expanded environmental analysis of the project alternatives.

1.1 Purpose and Scope of Supplement

This Supplement is being prepared to provide an expanded analysis of the five project alternatives discussed in Section V of the 2008 Scoping Plan FED (ARB 2009). The Supplement provides a revised analysis that, if approved by the Board, will supersede and replace the project alternatives section of the FED found at pages J-74 to J-90.

In currently pending litigation, a California State trial court found that the analysis of the alternatives identified in the FED was not sufficient for informed decision-making and public review under CEQA (*Association of Irritated Residents, et al. v. California Air Resources Board, et al*., San Francisco Superior Court, Case Number CPF-09-509562, May 20, 2011). ARB disagrees with the trial court finding and has appealed the decision. However, to remove any doubt about the matter, and congruent with ARB's interest in public participation and informed decision-making, ARB is revisiting the Scoping Plan alternatives. Therefore, staff is providing this supplemental analysis of the project alternatives.

Based on the expanded analysis of project alternatives in this Supplement, the Board will reconsider its approval of the 2008 Scoping Plan. As explained in Section 1.0 above, since the Plan is being brought back for reconsideration, it is referred to in this Supplement as the "Proposed Scoping Plan." The Proposed Scoping Plan contains the same objectives and framework for GHG reduction as the 2008 Scoping Plan. There are, however, a few changes that have occurred since the 2008 Scoping Plan was adopted that are taken into account in this new expanded alternatives analysis. First, this Supplement relies on emissions projections updated in light of current economic forecasts (i.e., accounting for the economic downturn since 2008). In addition, the Proposed Scoping Plan excludes one measure identified in the 2008 Scoping Plan that has been adopted as of publication of this Supplement, and one measure no longer under consideration by ARB. More detailed information about these changes is provided below in Section 1.2 under the heading 'Proposed Scoping Plan Description.'

The five alternatives analyzed in this Supplement are the same as those considered in the 2008 FED, i.e., the No-Project Alternative, as required by CEQA, and four action alternatives. Each of the action alternatives is a feasible alternative to the proposed project that could potentially attain most of the project's basic objectives, including reducing statewide GHG emissions to 1990 levels by 2020, as mandated by AB 32. This document, like the FED it supplements and others typical for policy and regulatory matters, contains a programmatic level of environmental review. (See CCR section 15168 ["Program EIR"].) One of the purposes of a program environmental document is to consider broad policy and regulatory alternatives to a proposed project (see CCR section 15168(b)(4)), which is the primary goal of this Supplement. The level of detail in this Supplement reflects that the project is a broad plan, and therefore, the analysis does not provide the level of detail that will be provided in subsequent environmental documents prepared for each regulation ARB pursues to reduce GHGs. (See CCR section 15152.)

1.2 AB 32 Background and the Proposed Scoping Plan Overview

To provide context for the analysis of the project alternatives, this section presents an overview of the statutory and regulatory framework behind the Proposed Scoping Plan, followed by a description of Scoping Plan objectives and a brief description of the Proposed Scoping Plan.

Statutory and Regulatory Framework

On September 27, 2006, Governor Schwarzenegger signed Assembly Bill AB 32. By requiring in law a reduction of GHG emissions to 1990 levels by 2020, California set the stage for its transition to a sustainable, clean energy future. ARB is the lead agency for implementing AB 32, which set major milestones for establishing the overall program.

More specifically, AB 32 includes the following requirements for ARB:

- Identify the statewide level of GHG emissions in 1990 to serve as the emissions limit to be achieved by 2020 (HSC section 38550). In December 2007, the Board approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent (MMTCO_2E) of GHGs.

- Adopt a regulation requiring the mandatory reporting of GHG emissions (HSC section 38530). In December 2007, the Board adopted a regulation requiring the largest industrial sources to report and verify their GHG emissions.

- Identify and adopt regulations for Discrete Early Actions that could be enforceable on or before January 1, 2010, (HSC section 38560.5). Beginning in 2007, the Board identified and approved nine Discrete Early Action measures including regulations affecting landfills, motor vehicle fuels, refrigerants in cars, port operations and other sources.

  Develop a “Scoping Plan” that outlines the State’s strategy to achieve the 2020 GHG emissions limit. A Scoping Plan sets forth those strategies that, at the time of the adoption of the Plan, ARB believes would be best to pursue. Adoption of a Scoping Plan does not, however, mean that ARB is giving final approval to every strategy contained in that Plan. A substantial number of the strategies contained in an approved Scoping Plan will require their own regulatory processes, at the end of which ARB may choose a course that is different from that set forth in a Scoping Plan. Furthermore, adoption of a Scoping Plan is not a condition precedent for the adoption of greenhouse gas reduction measures ARB may pursue under other provisions of AB 32.

- Convene an Environmental Justice Advisory Committee (EJAC) to advise the Board in developing the Scoping Plan and any other pertinent matter in implementing AB 32 (HSC section 38591). The EJAC met numerous times, providing comments on the proposed Early Action measures and the

development of the Scoping Plan, and submitted its comments and recommendations on the 2008 draft Scoping Plan.

- Appoint an Economic and Technology Advancement Advisory Committee (ETAAC) to provide recommendations for technologies, research and GHG emission reduction measures (HSC section 38591). After a year-long public process, the ETAAC submitted a report of their recommendations to the Board in February 2008. The ETAAC also reviewed and provided comments on the 2008 draft Scoping Plan.

- On or before January 1, 2011, adopt greenhouse emission limits and emission reduction measures by regulation to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions in furtherance of achieving the statewide greenhouse emissions limit, to become operative beginning on January 1, 2012 (HSC section 38562).

Scoping Plan Objectives

The objectives in adopting a Scoping Plan are important in considering the Proposed Scoping Plan and the project alternatives. In addition to discussing the environmental effects of the project alternatives, this Supplement also addresses whether and how the Proposed Scoping Plan and the project alternatives meet these objectives. The following objectives are derived from the requirements of AB 32 for the Scoping Plan (HSC section 38561) and for the adoption of emission reduction measures by regulation (HSC section 38562), including market-based regulations (HSC section 38570). ARB's consideration of the ability of the Proposed Scoping Plan and the project alternatives to meet these objectives is conducted at a programmatic level, and the analysis herein does not replace the more detailed "project level" review for proposed measures or regulations pursued pursuant to Health and Safety Code sections 38562 and 38570.

1. Establish regulations to meet the 2020 goal – to establish regulations that implement reduction strategies covering the state's GHG emissions in furtherance of California's mandate to reduce GHG emissions to 1990 levels by 2020;

2. Reduce fossil fuel use – to reduce California's reliance on fossil fuels and diversify energy sources while maintaining electric system reliability;

3. Link with partners – to link, where feasible, with other Western Climate Initiative (WCI) partner programs to create a regional market system;

4. Design an enforceable, amendable program – to design a program that is enforceable and that is capable of being monitored and verified;

5. Ensure emission reductions – to pursue emissions reductions that are real, permanent, quantifiable, verifiable and enforceable;

6. Achieve technologically feasible and cost-effective reductions – to achieve the maximum technologically feasible and cost-effective reductions in GHG emissions in the aggregate from sources or categories of sources under the cap, in furtherance of achieving the statewide GHG emissions limit (HSC section 38562, subd. (a) and (c);

7. Avoid disproportionate impacts – to ensure, to the extent feasible, that activities undertaken to comply with the regulations do not disproportionately impact low-income communities (HSC section 38562, subd. (b)(2));

8. Credit early action - to ensure, to the extent feasible, that entities that have voluntarily reduced their GHG emissions prior to the implementation of regulations receive appropriate credit for early voluntary actions (HSC section 38562, subd. (b)(3));

9. Complement existing air standards – to ensure, to the extent feasible, that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain national and California Air Quality Attainment Standards and to reduce toxic air contaminant (TAC) emissions (HSC, section 38562, subd. (b)(4));

10. Consider a broad range of public benefits – to consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health (HSC section 38562, subd. (b)(6));

11. Minimize administrative burden – to minimize, to the extent feasible, the administrative burden of implementing and complying with the regulation (HSC section 38562, subd. (b)(7));

12. Minimize leakage – to minimize, to the extent feasible, leakage of emissions to states and countries without a mandatory GHG emission cap (HSC section 38562, subd. (b)(8));

13. Weigh relative emissions – to consider, to the extent feasible, the contribution of each source or category of sources to statewide emissions of GHGs (HSC section 38562, subd. (b)(9));

14. Achieve real emission reductions in market-based strategies – to ensure that GHG emission reductions achieved through any market-based compliance mechanisms are real, permanent, quantifiable, verifiable and enforceable by the Board (HSC section 38562, subd. (d)(1));

15. Achieve reductions over existing regulation using market-based strategies – to ensure that the reductions from any market-based compliance mechanisms are in addition to any GHG emissions reductions otherwise required by law or

regulation, and any other GHG emissions reduction that would otherwise occur (HSC section 38562, subd. (d)(2));

16. Complement direct measures – to ensure, if applicable, that the GHG emissions reduction from a market-based compliance mechanism occurs over the same time period and is equivalent in amount to any direct emissions reduction required pursuant to AB 32 (HSC section 38562, subd. (d)(3));

17. Consider emissions impacts – to consider, to the extent feasible, the potential for direct, indirect, and cumulative emissions impacts from a market-based compliance mechanism, including localized impacts in communities that are already adversely impacted by air pollution (HSC section 38570, subd. (b)(1));

18. Prevent increases in other pollutant emissions – to design, to the extent feasible, any market-based compliance mechanism to prevent any increase in the emissions of criteria air pollutants or TACs (HSC section 38570, subd. (b)(2));

19. Maximize co-benefits – to maximize, to the extent feasible, additional environmental and economic benefits for California, as appropriate (HSC section 38570, subd. (b)(3)); and

20. Avoid duplication – to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements HSC sections 38501(g) and 38561(a)).

Proposed Scoping Plan Description

The Proposed Scoping Plan referenced in this Supplement is substantially the same Scoping Plan considered by the Board in 2008, and therefore, contains the same objectives and framework of measures for GHG reduction described in the 2008 Scoping Plan (ARB 2009).

The Proposed Scoping Plan, as described within the 2008 Scoping Plan document, was developed by ARB in coordination with the Climate Action Team and considers a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce dependence on oil, diversify energy sources, save energy, create new jobs, and enhance public health. The Plan analyzes a mix of measures that provide a comprehensive approach to reduce GHG emissions to achieve the 2020 target, and to initiate the transformations required to achieve the long range target reflected in California Executive Order S-3-05 (an 80 percent reduction from 1990 levels by 2050). The emission reduction measures are described in detail in the Scoping Plan document (ARB 2009). A description of the proposed actions is also provided in the FED at pp. J-20 - J-21, Volume III of the 2008 Scoping Plan (ARB 2009, pp. J-20 - J-21). The information below is provided to summarize and supplement that description to provide context for this expanded analysis of project alternatives.

Overview of Strategies in the Proposed Scoping Plan

Because discussions of the alternatives sometimes use the Proposed Scoping Plan as a point of comparison, it is helpful to summarize the key strategies in the Proposed Scoping Plan as a foundation of the alternatives analysis. A description of the Proposed Scoping Plan actions is also provided in the FED at pp. J-20 - J-21, in Volume III of the 2008 Scoping Plan (ARB 2009, pp. J-20 - J-21).

Achieving the goals of AB 32 in a cost-effective manner will require a wide range of approaches. Every part of California's economy needs to play a role in reducing GHGs. ARB's comprehensive GHG emissions inventory lists sources ranging from the largest refineries and power plants to small industrial processes and farm livestock. The measures in the Proposed Scoping Plan were developed to reduce GHG emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put California on a path to meet the long-term 2050 goal of reducing California's GHG emissions to 80 percent below 1990 levels. This trajectory is consistent with the reductions that are needed globally to help stabilize the climate.

In developing the 2008 Scoping Plan, ARB staff evaluated a comprehensive array of candidate approaches and tools that could best achieve these emission reductions. Based on available data and literature, staff concluded that reducing GHG emissions from the wide variety of sources could best be accomplished though a comprehensive set of measures that includes market-based regulatory approaches, other regulations, voluntary measures, fees, policies, and programs. This comprehensive approach is still reflected in the Proposed Scoping Plan. ARB will monitor implementation of the measures pursued to ensure that the state meets the 2020 limit on GHG emissions. As proposed, an overall limit on GHG emissions from most of the California economy – the "capped sectors" – would be established by the Cap-and-Trade Program. Within the capped sectors, some of the reductions would be accomplished through direct regulations, such as improved building efficiency standards and GHG emission standards for vehicles. Whatever additional reductions are needed to bring emissions within the cap would be mandated by the firm cap on emissions; the actions taken to reduce emissions would be motivated by the emissions allowance prices. Together, direct regulation and the emissions cap assure that emissions are brought down cost-effectively to the level of the overall cap. Staff also recommends specific measures for the remainder of the economy, i.e., the "uncapped sectors."

Key elements of Proposed Scoping Plan for reducing California's GHG emissions to 1990 levels by 2020 include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide electricity generation portfolio consisting of 33 percent renewable sources;
- Developing a California Cap-and-Trade Program that links with other Western Climate Initiative partner programs to create a regional market system;
- Establishing targets for transportation-related GHG emissions for regions throughout California and pursuing policies and incentives to achieve those targets; and
- Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard (LCFS).

The total reduction for the measures recommended in the 2008 Scoping Plan was originally estimated at 174 $MMTCO_2E$, as measured against the level of emissions that would result if there were no reductions measures, and if the State were to proceed on its pre-AB 32 emissions track. This benchmark is referred to as "business as usual", or "BAU." Staff notes that after the passage of AB 32, the BAU level of emissions is prohibited by law, because AB 32 requires the State to adopt regulations to achieve the maximum technologically feasible GHG emissions reduction in order to reduce GHGs. The measures listed in Table 1.2-1 would lead to emission reductions from sources within the capped sectors and from both sources or sectors not covered by the Cap-and-Trade Program. Table 1.2-1 also lists several other recommended measures that would contribute toward achieving the 2020 statewide goal, but whose reductions are not (for various reasons including the potential for double counting) additive with the other measures.

This mix of measures builds on a strong foundation of previous action in California to address climate change and broader environmental issues. The Proposed Scoping Plan relies on implementing existing laws and regulations that were adopted to reduce GHG emissions and other policy goals; strengthening and expanding existing programs; implementing the Discrete Early Actions adopted by the Board beginning in 2007; and proposed measures developed during the Scoping Plan process, itself.

Table 1.2-1 Greenhouse Gas Reduction Measures and Estimated Reductions as Originally Proposed in 2008

Recommended Reduction Measures	Reductions Counted Toward 2020 Target ($MMTCO_2E$)
Estimated Reductions Resulting from the Combination of Measures	**146.7**
California Light-Duty Vehicle Greenhouse Gas Standards • Implement Pavley standards • Develop Pavley II light-duty vehicle standards	31.7
Energy Efficiency • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)	26.3
Renewables Energy Portfolio Standard (33 Percent by 2020)	21.3
Low Carbon Fuel Standard	15
Regional Transportation-Related GHG Targets[1]	5
Vehicle Efficiency Measures	4.5
Goods Movement • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.7
Advanced Clean Cars • Medium/Heavy Duty Vehicles • Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) • Medium-and Heavy-Duty Vehicle Hybridization	2.1 1.4
High Speed Rail	1.0
Industrial Measures (for sources covered under Cap-and-Trade Program) • Refinery Measures • Energy Efficiency & Co-Benefits Audits	0.3
Additional Reductions Necessary to Achieve the Cap	34.4

Table 1.2-1 Greenhouse Gas Reduction Measures and Estimated Reductions as Originally Proposed in 2008

Recommended Reduction Measures	Reductions Counted Toward 2020 Target ($MMTCO_2E$)
Estimated Reductions From Uncapped Sources/Sectors	**27.3**
High Global Warming Potential Gas Measures	20.2
Sustainable Forests	5.0
Industrial Measures (for sources not covered under Cap-and-Trade Program) • Oil and Gas Extraction and Transmission	1.1
Recycling and Waste (landfill methane capture)	1.0
Total Reductions Counted Towards 2020 Target	**174**
Other Recommended Measures	**Estimated 2020 Reductions ($MMTCO_2E$)**
State Government Operations	1-2
Local Government Operations	TBD
Green Buildings	26
Recycling and Waste • Mandatory Commercial Recycling • Other measures	9
Water Sector Measures	4.8
Methane Capture at Large Dairies	1.0

[1] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB established regional targets for each Metropolitan Planning Organization (MPO) region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

Source: ARB 2009

Updated BAU Emissions Projections

Since 2008, ARB has updated projected BAU emissions based on current economic forecasts (i.e., as influenced by the economic downturn) and reduction measures already in place. The BAU projection for 2020 GHG emissions in California was originally estimated to be 596 $MMTCO_2E$. Table 1.2-2 indicates an updated calculation of the Proposed Scoping Plan's estimates for projected emissions in 2020 as of October 2010, based on current economic forecasts. ARB staff derived the updated emissions estimates by projecting emissions from a past baseline estimate using three-year average emissions, by sector, for 2006-2008 and considering the influence of the recent recession and reduction measures that are already in place. Growth factors specific to each of the different economic sectors were used to forecast emissions to 2020. This

three-year average of known emissions dampened unusual variations in any single year that would make the baseline year unrepresentative for forecasting.

Table 1.2-2 Updated 2020 Business-as-Usual Emissions Forecast

Sector	$MMTCO_2E$	Percent
Uncapped Sectors (electricity, industrial, transportation, agriculture/forestry, commercial, residential, high GWP gases)	97.9	19.3
Broad Scope Fuels Capped Upstream (gasoline, distillate, propane, natural gas)	236.3	46.6
Capped Industrial (cement, cogeneration, hydrogen plants, refineries, other, combustion)	74.2	14.6
Imported Electricity (capped)	53.5	10.6
In-state Electricity (capped)	44.8	8.8
Emissions Total	**506.8**	

Considering the updated BAU estimate of 507 $MMTCO_2E$ by 2020, a 16 percent reduction below the estimated BAU levels would be necessary to return to 1990 levels (i.e., 427 $MMTCO_2E$) by 2020. No one sector has a sufficiently large share of GHG emissions to become the primary focus for emission reductions. Significant reductions are needed in the transportation, electricity, commercial and residential, and industrial sectors, as well as contributing reductions from the other sectors of the economy. Consequently, multi-faceted GHG emissions strategies have been initiated and are underway since the 2006 enactment of AB 32.

While ARB has compiled, analyzed, and described its full range of proposed, necessary GHG strategies as part of the Proposed Scoping Plan, many of these strategies have either been implemented and are ongoing or have authority under other statutes and will proceed regardless of the outcome of the reconsideration of the Proposed Scoping Plan. (Please refer to the more detailed discussion and measures listed in the Section 2.3, Table 2.3-1, under the No-Project Alternative.) One measure identified in the 2008 Scoping Plan, Refrigerant Management Program, was proposed and approved by the Board following their initial approval of the Scoping Plan in 2008. The regulations for the Refrigerant Management Program are in effect, and therefore, this measure will proceed because it is already codified. The 2008 Scoping Plan also included a measure to reduce GHG emissions from high global warming potential (GWP) gases via a fee. However, staff's evaluation of this measure since the 2008 Scoping Plan was initially developed, indicates that at this time a regulation to levy a fee to reduce emissions from high GWP gases would not be feasible. Therefore, this measure will no longer be pursued as part of the Proposed Scoping Plan (see discussion under Alternative 3).

Considering the ongoing, approved, or otherwise authorized measures that would occur even if no Scoping Plan measures were implemented (a result not allowed under AB 32), and the updated calculation of the estimated BAU emissions, the shortfall from the AB 32 target that would need to be obtained by remaining measures in the Proposed Scoping Plan would be approximately 22 $MMTCO_2E$. This estimate is summarized in Table 1.2-3, below.

Table 1.2-3 Estimate of Emissions Reductions Needed from Proposed Scoping Plan Measures Not Yet In Place

Emission Category	2020 MMTCO2E
Revised 2020 Baseline (Business-as-Usual) Forecast	507
Reductions from measures (other than the Cap-and-Trade Program and Advanced Clean Cars)	58
2020 Emissions Target set by AB 32 (i.e., 1990 level)	427
Reductions Needed from Cap-and-Trade and Advanced Clean Cars as Proposed	**22**

The shortfall of the AB 32 target is the allocation of GHG reduction that has been estimated to be gained from a Cap-and-Trade Program (18 $MMTCO_2E$) and an advanced clean car program (4 $MMTCO_2E$) that are included as measures to be pursued as part of the Proposed Scoping Plan.

The mix of measures in the Proposed Scoping Plan provides a comprehensive approach to reduce emissions to achieve the 2020 target, and to initiate the transformations required to achieve the 2050 target set forth in Executive Order S-03-05 (80% below 1990 levels by 2050). The Cap-and-Trade Program included in the Proposed Scoping Plan would cover about 85 percent of GHG emissions throughout California's economy. ARB recognizes that due to several factors, including information discovered during regulatory development, technology maturity, and implementation challenges, actual reductions from individual measures aimed at achieving the 2020 target may be higher or lower than current estimates. The inclusion of many of these emissions within the Cap-and-Trade Program, along with a margin of safety in the uncapped sectors, would help ensure that the 2020 target is met.

2.0 SCOPING PLAN ALTERNATIVES

This section provides an overview of the regulatory requirements and guidance regarding the alternatives analyses under CEQA, a description of each of the alternatives to the Proposed Scoping Plan, a discussion of whether and how each Alternative meets the project's objectives, and an analysis of each alternative's environmental impacts.

2.1 Alternatives Development and Approach to Analysis

California Environmental Quality Act and Functional Equivalency

ARB's process of adopting regulations is a Certified State Regulatory Program under CEQA. Public Resources Code (PRC) section 21080.5 allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report once the Secretary of the Natural Resources Agency has certified the regulatory program. The California Secretary for Natural Resources has determined that ARB's regulatory program meets the criteria for a Certified State Regulatory Program (CCR section 15251(d)). This certification allows ARB, when adopting rules, regulations, standards and plans, to use a substitute, functional equivalent document in lieu of formal Initial Studies, Negative Declarations, or Environmental Impact Reports (EIRs) required by CEQA. The 2008 Scoping Plan FED and this Supplement was prepared pursuant to the ARB Certified Regulatory Program to assess the potential environmental effects of the GHG emissions reduction programs and strategies.

Requirements for Alternatives Analysis

ARB's Certified Regulatory Program (CCR sections 60005 – 60007) requires that where a contemplated action may have a significant effect on the environment, a staff report shall be prepared in a manner consistent with the environmental protection purposes of the state board's regulatory program and with the goals and policies of CEQA. Among other things, staff reports are required to address feasible alternatives to the proposed action that would substantially reduce any significant adverse impact identified. The regulation specifies that:

> Any action or proposal for which significant adverse environmental impacts have been identified during the review process shall not be approved or adopted as proposed if there are feasible mitigation measures or feasible alternatives available which would substantially reduce such adverse impact. For purposes of this section, "feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors, and consistent with the state board's legislatively mandated responsibilities and duties (CCR section 60006).

No more specific guidance (e.g., number, nature, location, or characteristics of alternatives) is provided in the regulation.

While ARB, by virtue of its Certified Regulatory Program, is exempt from Chapters 3 and 4 of CEQA and corresponding sections of the State CEQA Guidelines, the Guidelines nevertheless contain useful information for preparation of a thorough and meaningful alternatives analysis. CEQA Guidelines section 15126.6(a) speaks to evaluation of "a range of reasonable alternatives to the project, or the location of the project, which would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects, and evaluate the comparative merits of the alternatives." The purpose of the alternatives analysis is to determine whether or not a variation of the project would reduce or eliminate significant project impacts, within the basic framework of the objectives, a principle that is consistent with ARB's Certified Regulatory Program requirements.

Thus, alternatives considered in an environmental document should be feasible and should attain basic project objectives. Under AB 32, ARB is required to adopt a Scoping Plan to guide its future regulatory efforts under AB 32. Objectives of a Scoping Plan are described in Section 1.2, above, and speak primarily to GHG emissions reduction, and creation of a system to achieve those reductions that is administratively feasible, enforceable, cost-effective, efficient, and fair.

The range of alternatives studied in an environmental document is governed by the "rule of reason," requiring evaluation of only those alternatives "necessary to permit a reasoned choice" (CCR 15126.6(f)). Further, an agency "need not consider an Alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative" (CCR 15126.6(f)(3)). The analysis should focus on alternatives that are feasible (defined above) and that take economic, environmental, social, and technological factors into account. Alternatives that are remote or speculative need not be discussed. Furthermore, the alternatives analyzed for a project should focus on reducing or avoiding significant environmental impacts associated with the project as proposed.

Direction from the Superior Court Regarding the Alternatives Analysis

On May 20, 2011, the San Francisco County Superior Court (Case Number CPR-09-509562) issued its Final Order. The Order stated, inter alia, that "ARB… failed to proceed in a manner required by law by inadequately describing and analyzing Project Alternatives sufficient for informed decision making and public participation." The court further ordered ARB to "set aside Board Resolution 08-47 and Executive Order G-09-001 adopting and approving the Climate Change Scoping Plan to reduce greenhouse gases in California ("Project") as it relates to cap-and-trade." As stated above, while ARB disagrees with these findings and is appealing the decision, and has not taken action to set aside Board Resolution 08-47 and Executive Order G-09-001 at this time, in the interest of public participation and informed decision-making, this FED

Supplement has been prepared to elaborate on the Project Alternatives. (See Section 1.1, Purpose and Scope of This Supplement.)

The Court did not find the number and nature of alternatives considered in the Scoping Plan FED to be insufficient. Therefore, this FED Supplement addresses the same alternatives, but with more in-depth description of those alternatives, and more expansive analysis of potential environmental impacts.

As noted above, ARB will reconsider its decision to adopt the Proposed Scoping Plan. At a public meeting, the Board will make a new decision whether to adopt the Proposed Scoping Plan, one of the action alternatives discussed in this Supplement, or a variation of the Proposed Scoping Plan or an alternative, based on the information contained in the FED, the Supplement, public comments, and responses to comments.

2.2 Description and Analysis of Alternatives

Introduction

If adopted and approved by the Board, this alternatives description and analysis of the alternatives will supersede and replace the alternatives discussion presented in the Scoping Plan FED, released in October 2008, at pp. J-20 - J-21, in Volume III of the 2008 Scoping Plan (ARB 2009, pp. J-20 – J-21). (A Notice of Decision regarding the Board's action on the Scoping Plan was filed with the Secretary of the California Resources Agency on May 9, 2009.) This document expands the description and analysis of the alternatives to assist both the Board and the public in their consideration of alternatives to the Scoping Plan. The five alternatives discussed are the same as those that were originally presented in the 2008 Scoping Plan FED; however, they have been updated and re-ordered to reflect current circumstances. The order in which the alternatives are discussed is changed from the FED to the Supplement to present the alternatives that focus on single strategies first, followed by the alternatives considering a combination of those strategies.

Range and Description of Alternatives

Because a Scoping Plan is a framework document made up of a set of numerous individual GHG emission reduction measures that can be combined in different ways, there is, in theory, an almost limitless number of potential alternatives that could serve as the Proposed Scoping Plan. The five alternatives discussed in this section represent a reasonable range of representative alternatives that will allow the public and Board to understand the differences between different types or combination of approaches.

ARB staff developed the range of representative alternatives based on a thorough, informed, and public process. In 2008, ARB staff originally determined the range of alternatives based on extensive input from the public and advisory committees during the course of a lengthy public process in the development of its Proposed Scoping Plan. In addition to input from the public, ARB received and relied upon input on Scoping Plan alternatives from three specially formed advisory committees. The

Environmental Justice Advisory Committee (EJAC) and the Economic and Technology Advancement Advisory Committee (ETAAC), both formed by ARB pursuant to HSC section 38591, provided both oral and written recommendations and comment to ARB. Further, ARB received input from the Market Advisory Committee (MAC), formed in 2006 by Governor Executive Order S-20-06. The MAC included leading experts from universities, government, non-governmental organizations and private industry.

ARB staff and Board members also met with representatives of national and sub-national governments that are currently operating programs to reduce GHG emissions, including emissions trading programs. For example, ARB staff and/or Board members met with representatives of the U.S. Environmental Protection Agency (U.S. EPA), which manages the Acid Rain and NO_x emissions trading programs; the South Coast Air Quality Management District (SCAQMD), which administers the Regional Clean Air Incentives Market (RECLAIM) emissions trading program; the Environmental Ministry of British Columbia, which has established a carbon fee program for GHG emissions from transportation fuels and is developing a cap-and-trade program for industrial and power sector GHG emissions; and the British Government and the European Commission, which oversees the European Union's Emissions Trading Program (EU-ETS).

Further, ARB staff has collected and reviewed an extensive library of literature on reduction programs, including cap-and-trade, fees, taxes, source-specific standards and limits, and other regulatory approaches. Documents incorporated by reference are listed in Section 3.0.

Adoption of Regulations for Any Alternative

Typically, air quality and GHG controls would be implemented by adoption of regulations. If ARB pursued regulations to implement any of the GHG reduction alternatives discussed in this Supplement, each regulation would go through the Administrative Procedure Act (APA) process. It is a rigorous process that includes technical, environmental, and economic analysis, as well as public review and input. The APA provides very specific rules for this process of adopting new regulations. This process must be completed within one year of the notice date (see below), pursuant to Government Code section 11346.4(b).

First, a notice of proposed action must be filed with the Office of Administrative Law (OAL), consistent with Government Code section 11346.5. The Initial Statement of Reasons (ISOR), also known as the Staff Report, is published at the same time as the notice, and contains all of ARB's reasoning for the proposed regulations (Government Code section 11346.2(b)). Concurrently with the publication of the notice and ISOR, the specific terms of the proposed regulation(s) must also be made available (Government Code section 11346.2(a)). The initial publication of the notice, ISOR, and proposed regulations results in the "notice date."

The public is given at least 45 days to provide comments on the proposed regulation and, if a public hearing is scheduled (which ARB does for almost all regulations), the commenters may also provide comment at the hearing (Government Code

section 11346.4(a)). ARB must consider public comments and, in conjunction with any Board direction, make any substantive changes warranted in light of the comments or Board direction. Substantive changes must be made available for an additional 15 days of public review (Government Code section 11346.8(c)). If additional substantive changes are required after the 15-day review, the regulations must be made available for subsequent 15-day periods until all substantive changes are complete.

After the conclusion of all 15-day public comment periods, ARB prepares a Final Statement of Reasons (FSOR), which includes ARB's responses to each comment received during the public comment periods. After final approval by ARB, staff also compiles the remainder of the rulemaking file, which includes the Updated Informative Digest, all of the comments received, the transcript of the hearing, the final regulation text, the table of contents of the rulemaking file, various economic analyses required by the Department of Finance, and mailing statements.

Within the one year provided from the initial notice date, ARB must file the documents listed above with OAL. Within 30 working days, OAL must review the file to ensure that ARB complied with all of the APA requirements, and must make a decision on whether to approve or disapprove the regulation. A regulation does not become legally effective unless it is approved by OAL. When OAL approves a regulation, it is filed with the California Secretary of State and becomes effective 30 days after filing, although an earlier effective date may be requested.

Analysis of Alternatives

This Supplement examines the "range of reasonable alternatives" to the project to evaluate whether reasonable alternatives to the Proposed Scoping Plan would reduce or eliminate the project's significant effects on the environment, while meeting at least most of the basic project objectives. (See CCR section 15126.6(a).) Pursuant to ARB's Certified Regulatory Program, the second part of this section contains an analysis of each alternative's feasibility and its ability or inability to substantially reduce any significant adverse environmental impacts identified in the FED's analysis of the Proposed Scoping Plan (CCR sections 60005(b) and 60006).

The basic project objectives of the Proposed Scoping Plan are discussed in Part 1.2, above. The analysis that follows the descriptions of the alternatives includes a discussion of the degree to which each Alternative meets those basic project objectives.

Range of Alternatives

The five alternatives to the Proposed Scoping Plan evaluated by ARB in this Supplement are:

- **Alternative 1: No-Project Alternative.** The No-Project Alternative is based on existing conditions and what would be reasonably expected to occur in the foreseeable future. As a result, the description of this Alternative has been updated to reflect the current status of ARB programs. Existing conditions, therefore, include the suite of GHG reduction actions that are in operation, such

as the million-solar-roofs program, the AB 1493 (Pavley) motor vehicle GHG emission standards, and the Low Carbon Fuels Standard. In addition, for purposes of this analysis, ARB has included as "reasonably expected to occur in the foreseeable future," those GHG reduction actions with additional statutory authority, such as the 33 percent Renewable Energy Portfolio Standard (RPS) for electricity generation, which is now authorized by Senate Bill 2 of the first extraordinary sessions of 2011 (Simitian, Statutes of 2011) (SB1X 2), but excluded rulemakings pursuant to AB 32 that are still in process, such as the California Cap on GHG Emissions and Market-Based Compliance Mechanisms (also known as the Cap-and-Trade Regulation). ARB believes that the proposed Cap-and-Trade Regulation and other emission reduction measures are independently authorized by the HSC section 38562, irrespective of the Scoping Plan; however, the issue is presently the subject of the litigation noted in Section 2.1, above.

- **Alternative 2: Adopt a Program Based on Cap-and-Trade for the Sectors Included in the Cap.** This Alternative relies primarily on a cap-and-trade program for achieving the remaining reductions (i.e., approximately 22 $MMTCO_2E$ after other ongoing, implemented, or otherwise authorized measures) needed to meet the 2020 GHG reduction target. The description of Alternative 2 has been updated to reflect the October 2010 proposed Cap-and-Trade Regulation that has been evaluated in a separate FED that ARB released for public review in October 2010 (ARB 2010b).

- **Alternative 3: Adopt a Program Based on Source-Specific Regulatory Requirements.** Under this alternative, ARB would adopt a program that relies on additional direct regulatory control of specific sector sources of GHG emissions to achieve the remaining reductions (i.e., approximately 22 $MMTCO_2E$ after other ongoing, implemented, or otherwise authorized measures) needed to meet the 2020 GHG reduction target. Also sometimes called a direct regulatory approach, Alternative 3 would involve adopting regulations that establish source-specific emissions limits or performance standards and require regulated entities to stay within those limits.

- **Alternative 4: Adopt a Program Based on a Carbon Fee or Tax.** Under this alternative, ARB would adopt a program that relies on a carbon fee or tax program to achieve the remaining reductions (i.e., approximately 22 $MMTCO_2E$ after other ongoing, implemented, or otherwise authorized measures) needed to meet the 2020 GHG reduction target. Alternative 4 could involve a regulation setting fees payable to the state based on the GHG emissions by covered entities, and directing the expenditure of the fee revenue for specified uses, subject to substantial administrative constraints. The description also discusses a carbon tax, which would require a legislative supermajority for authorization, but is not subject to the same administrative constraints.

- **Alternative 5: Adopt a Variation of the Proposed Strategies or Measures.** Under this alternative, ARB would adopt either a subset or a different combination of the measures considered among the other previous three action alternatives.

As presented previously, a shortfall of approximately 22 $MMTCO_2E$ from the AB 32 target in 2020 would occur after accounting for the ongoing, approved, or otherwise authorized GHG reduction measures that would continue if the full scope of the Proposed Scoping Plan did not proceed. The alternatives described below are discussed in light of the need to achieve this additional 22 $MMTCO_2E$ reduction.

Detailed descriptions of the five alternatives are presented below.

2.3 Alternative 1: No-Project Alternative

Goal of Alternative 1

The goal of Alternative 1 is to describe a reasonably expected scenario if ARB did not adopt the Proposed Scoping Plan or any of the action alternatives to the Proposed Scoping Plan. The No-Project Alternative is included only to assist in the analysis and consideration of the Proposed Scoping Plan and the action alternatives. ARB cannot adopt the No-Project Alternative described in this document because AB 32 requires ARB to prepare and approve a Scoping Plan (HSC section 38561(a)).

Role of Alternative 1 in the Range of Alternatives

ARB's Certified Regulatory Program does not mandate consideration of a "No-Project Alternative." (See CCR section 60006.) Under the Certified Regulatory Program, the alternatives ARB considers, among other things, must be "consistent with the state board's legislatively mandated responsibilities and duties" (CCR section 60006). Here, ARB is legislatively mandated to produce a Scoping Plan "as that term is understood by the Board, for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions from sources or categories of sources of GHGs by 2020 under this division"(HSC section 38561).

Although not in response to a regulatory mandate, it is useful to include a "No-Project Alternative" in this analysis for the same reasons that this type of Alternative is called for in the State CEQA Guidelines. As noted in the Guidelines, "the purpose of describing and analyzing a no-project Alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project" (CCR section 15126.6(e)(1)). In addition, the No-Project Alternative also provides an important point of comparison to understand the potential environmental benefits and impacts of the other alternatives. In addition, while CEQA documents typically assume that the adoption of a No-Project Alternative would result in no further action by the project proponent or lead agency, this is not true for some of the actions identified in the Scoping Plan, which pre-date and have been approved or implemented prior to its adoption or are underway pursuant to other statutory

authority. The State CEQA Guidelines indicate that the no-project Alternative can address the continuation of an existing plan or policy into the future (CCR section 15126.6(e)(3)(A)). For purposes of this analysis, the No-Project Alternative takes into account the components of the Proposed Scoping Plan that are either already implemented or being carried out under authority additional to AB 32.

Precedents or Examples of the Approach in Alternative 1

The No-Project Alternative is not modeled after a precedent or example from other GHG reduction programs. Rather, it is defined using the suite of reduction strategies that have already been implemented by the State or are reasonably expected to occur even without a Scoping Plan.

Attributes of Alternative 1

The No-Project Alternative has been updated in this Supplement to reflect current conditions. The primary condition that has changed since the original formulation of the Proposed Scoping Plan in 2008 is the implementation of a portion of the strategies included within it in the interim period. To understand the relative environmental impacts of instituting a No-Project Alternative in 2011, it is important to factor in the GHG reduction strategies that are already underway and reducing emissions at this time, or would be reasonably expected to continue because they are approved as part of AB 32 implementation or authorized by other statutes.

To determine the emissions resulting from the No-Project Alternative as defined above, this document first presents updated forecasts of the GHG emissions that would be expected from all sources by 2020, assuming (for the purposes of analysis) no further regulatory controls (i.e., business-as-usual, or BAU). The document then discusses the GHG emission reductions from measures that have been implemented or would be implemented independent of any upcoming action on the Proposed Scoping Plan by ARB and compare the resulting emissions to the AB 32 target, i.e., 1990 emissions levels.

If GHG reduction measures in the Proposed Scoping Plan were not implemented and BAU resource and energy use occurred at the rates existing when AB 32 was enacted (based on extrapolating 2004 data, the most current data available in 2006), 2020 GHG emissions in California were originally estimated to be 596 $MMTCO_2E$.
Table 1.2-3 indicates an updated calculation of the Proposed Scoping Plan's estimates for projected BAU emissions in 2020 as of October 2010. ARB staff derived the updated emissions estimates by projecting emissions from a past baseline estimate using three-year average emissions, by sector, for 2002-2004 and considering the influence of the recent recession and measures that are already in place. Growth factors specific to each of the different economic sectors were used to forecast emissions to 2020. This three-year average of known emissions dampens unusual variations that could make any single year unrepresentative for forecasting purposes. As shown in Table 1.2-2 (Section 1.2, above), the updated BAU estimate is 507 $MMTCO_2E$ by 2020, which is 16 percent above 1990 levels (i.e., 427 $MMTCO_2E$).

The measures identified in the Proposed Scoping Plan that have already been implemented include actions that preceded the Proposed Scoping Plan and discrete early-action measures intended to begin to reduce GHG while the more complicated proposals in the Proposed Scoping Plan were being evaluated. These precedent and discrete early-action strategies would continue as part of the No-Project Alternative. In addition, two measures have separate authority, Senate Bill 375 (Steinberg, Statutes of 2008) authorizing reductions in car and light truck GHG emissions through adoption of Sustainable Communities Strategies or Alternative Planning Strategies and achievement of a 33-percent RPS as authorized by SB1X 2. Implementation of these programs is reasonably expected to continue regardless of further action by ARB on a Scoping Plan, so they are included as part of the No-Project Alternative. One measure listed in the Proposed Scoping Plan, Refrigerant Management Program, has already been approved by ARB and regulations are in effect; therefore, this measure will proceed, because it is already codified. Consequently, it is included in the No-Project Alternative. The ongoing, approved, or foreseeable measures that constitute the No-Project Alternative are summarized in Table 2.3-1.

The two main drivers of GHG emissions in the No-Project Alternative involve population growth and current laws and regulations. Population growth in California will result in more vehicle miles traveled, more goods movement, greater water and energy demands, and more consumer products. In coordination with the local air districts, ARB submits a State Implementation Plan to the U.S. EPA Administrator that provide for implementation, maintenance, and enforcement of the ozone and particulate matter national ambient air quality standards. The SIP would remain in place, even if the Scoping Plan were not adopted, and would have an influence on GHG emissions.

Presented below is a summary of sector-based conditions that would reasonably be expected in the event that the No-Project Alternative could be implemented. Descriptions of the 2020 BAU forecasts for the major sectors of the emissions inventory, summarized in Table 1.2-2 (Section 1.2) are provided in the discussion. Reduction strategies that are ongoing, already implemented, or approved based on additional authority would reduce emissions below the BAU forecasts, as summarized in Table 2.3-1, but not sufficiently to meet the AB 32 goal by 2020. In addition to the reductions depicted in Table 2.3-1, an additional 5 $MMTCO_2e$ reduction is attributed to forests that reflects current conditions of a 5 $MMTCO_2e$ annual sink (a CO_2 uptake by forests). This results in “no net loss” of 5 $MMTCO_2e$ (or -5) annually to 2020. This sink is to be maintained via forest management practices.As discussed below, the shortfall from the AB 32 target would be approximately 22 $MMTCO_2E$. This shortfall reflects the absence of the Cap-and-Trade Program (18 $MMTCO_2E$) and advanced clean car program (4 $MMTCO_2E$), which are not a part of the No-Project Alternative.

Table 2.3-1 Measures That Compose the No-Project Alternative

1) MEASURES IN PROCESS PRIOR TO THE PROPOSED SCOPING PLAN

Measure (Measure No.)	Status	Reduction (If Applic.)
Title 24 Building and Appliance Energy Efficiency Standards (E-1, CR-1)	Ongoing	11.9
Solar Water Heating (CR-2)	Ongoing	0.1
20 Percent Renewable Portfolio Standard (E-3)	Ongoing	12.0
Million Solar Roofs (E-4)	Ongoing; Began Jan 2007	1.1
Pavley I	Considered by Board Sept 2004; Operative Oct 2005; Effective Jan 2006	26.1

2) DISCRETE EARLY ACTION MEASURES UNDERWAY

Measure (Measure No.)	Status	Reduction (If Applic.)
Shore Power (T-5)	Considered by Board Dec 2007; Effective Jan 2009; Amended June 2010	0.2
High GWP Consumer Products (H-4)	Considered by Board June 2008; Effective July 2009	0.2
Smart Ways - Heavy-Duty Trucks (T-7, T-8)	Considered by Board Dec 2008; Effective Jan 2010; amended May 28, 2009 (on-board diagnostics); Amendments considered by Board Dec 2010; Due to OAL Oct 28, 2011	0.9
Reductions from Mobile Air Conditioners (DIY Cans) (H-1)	Considered by Board Jan 2009; Effective March 2010	0.2
Semiconductor Manufacturing (H-3)	Considered by Board Feb 2009; Effective Jan 2010	0.2
SF6 Reductions (Non Electrical) (H-2)	Considered by Board Feb 2009; Effective Jan 2010	0.0
Tire Pressure Regulation (T-4)	Considered by Board Mar 2009; Effective Sept 2010	0.6
Low Carbon Fuel Standard (T-2)	Considered by Board April 2009; Effective April 2010	15.0
Landfill Methane Capture (RW-1)	Considered by Board June 2009; Effective June 2010	1.5

Measure (Measure No.)	Status	Reduction (If Applic.)
Energy Efficiency Audits for Industrial Sources (I-1)	Considered by Board July 2010; Filed with OAL May, 2011	0.0
SF_6 Leak Reduction in Electrical Appliances (H-6)	Considered by Board Feb 2009; Effective Jan 2010	0.1

3) MEASURES IN THE PROPOSED SCOPING PLAN, BUT HAVE AUTHORITY OUTSIDE AB 32

Measure (Measure No.)	Status	Reduction (If Applic.)
SB 375 Implementation (T-3)	Regional Targets established by Board Sept 2010	3.0
33-Percent Renewable Energy Portfolio Standard (E-3)	Authorized by SB1X 2 (Statutes of 2011); Planning and development actions underway.	11.4
High Speed Rail (T-9)	In design and development by High Speed Rail Authority. Voters approved Proposition 1a.	1.0

4) MEASURES IN THE PROPOSED SCOPING PLAN, ONLY AB 32 AUTHORITY, FINALIZED THROUGH OAL

Measure (Measure No.)	Status	Reduction (If Applic.)
Refrigerant Management Program (H-6)	Considered by Board Dec 2009; Effective Nov 2010	5.8

Source: ARB 2010c, updated October 28, 2010

State and Local Governments

State government would continue its current practices, policies, investments, and its influence with California local governments and other states. California state government would influence emissions from agricultural activities, forests, water use, resource use, electricity, vehicle fleets, buildings, planes, trains, and automobiles. The state owns and operates prisons, hospitals, military bases, veterans' homes, fairs, and office buildings. State government also leases hundreds of buildings, vehicles, and pieces of equipment, and can affect thousands of companies with whom it does business. State government's contribution to BAU conditions is included in the sectors below.

Local governments have authority over how and where business, commercial, and residential land uses are developed and operated in their communities. Working closely with metropolitan planning organizations, ARB recently adopted regulations that set transportation-related GHG reduction targets for automobiles and light trucks pursuant to SB 375. The intent of the law and the reduction targets are to help shift land use patterns, improve transit opportunities and use, and build on successful planning processes that support environmentally sustainable communities. This law is related to but independent of AB 32. Local governments' contribution to BAU conditions is included in the sectors below.

Transportation

Petroleum-based fuels supply 96 percent of California's transportation needs and will continue to provide a substantial portion into the future. The BAU forecast of GHG emissions in 2020 from the transportation sector as a whole are expected to increase from current levels to 183.9 $MMTCO_2E$. This forecasted increase is dominated by increases in emissions from on-road transportation, i.e., passenger cars and heavy-duty trucks. To forecast on-road transportation emissions, ARB staff used 2007 fuel sales data obtained from the California Board of Equalization and estimated 2020 emissions based on the growth in projected vehicle miles traveled (VMT) derived from the 2007 Emissions Factor Model (EMFAC2007). This BAU forecast assumes no change in vehicle fleet mix over time. The BAU forecast also assumes no reductions in VMT or airplane traffic due to the High Speed Rail (HSR) by 2020, although the HSR has completed environmental evaluations and is continuing through the design and development process independently of AB 32 implementation. Measures that are already in place to reduce transportation emissions are Pavley 1 and the Low Carbon Fuel Standard (LCFS). Pavley 1 was considered by the Board in September 2004 and went into effect in January 2006, with a reduction target of 26.1 $MMTCO_2E$. The LCFS was considered by the Board in April 2009 and made effective April 2010 with a reduction target of 15.0 $MMTCO_2E$.

Goods movement activities in California are projected to increase up to 250 percent between 2006 and 2020, as the United States increases its exports and imports in the globalized economy. This increase translates to more ship and truck trips in and around ports, and more truck activity between and at rail yards and distribution centers. Rail trips will probably not increase, as improvements in locomotive efficiencies accommodate larger hauls. Some of this growth may require new infrastructure to relieve traffic congestion and improve efficiencies, such as port and highway expansions. ARB adopted and is implementing a Goods Movement Emission Reduction Plan to reduce emissions from goods movement activities and to address regional ozone and particulate matter standards, as well as impacts on already adversely affected communities, which can be located near ports, railyards, and distribution centers.

California Energy Commission's (CEC) *2009 Integrated Energy Policy Report* indicates that by 2020, at current trends, more than 44 million Californians will consume between 14.5 and 15 billion gallons of gasoline and diesel fuel each year (after peaking at about

16 billion gallons in 2014). Such consumption, while decreasing somewhat as a result of high prices, improved efficiency, and Alternative fuels, would still require major investments in petroleum refinery and delivery infrastructure (CEC 2009, pp. 147-150). Assembly Bill 1007 (Pavley, Chapter 371, Statutes of 2005) directed the CEC and ARB to develop a plan to increase the use of Alternative fuels in California, effectively reducing California's demand on refineries. California's refineries also supply other western states, which are currently expected to increase their demands for gasoline and diesel into the future due to population growth. Fuel diversity has also been identified as a major policy objective in the CEC's *2003 Integrated Energy Policy Report*, and Governor Schwarzenegger's Executive Order S-06-06 and resultant Bioenergy Action Plan.

California's population is continuing to grow at 1.2 percent per year. Changes in land use decision-making will be needed to foster more compact, urban and transit-served development, which directly relates to the number of vehicle miles traveled (VMT). VMT growth further degrades air quality and increases detrimental health effects. A substantial proportion of the gains made by introducing cleaner vehicles and fuels could be eroded by increased VMT unless more efficient methods of urban and community planning and transit service measures are implemented.

Electricity and Natural Gas

Under the No-Project Alternative, population growth in California will affect electricity demand in two ways: the number of residents will increase the overall demand for electricity and natural gas, and the location of those residents, primarily in the state's inland areas, will change the pattern of energy use. Peak electricity demand is expected to increase from slightly under 63,000 MW in 2010 to 71,000 MW by 2020 (CEC 2009, p. 55). Trends toward larger homes and increases in electronic equipment will also increase demand. Historically, California's appliance and building efficiency standards were able to hold our per capita electricity and natural gas demands steady, but under a BAU scenario these programs will not be able to continue this trend through 2020 and new capacity would be needed (CEC 2007). As demands increase, older, less efficient and dirtier power plants would be expected to operate more frequently.

The pattern of energy use is important, because the electrical system is sized to accommodate peak demands. The base of the state's electrical demand is a minimum amount of energy demanded by the state all the time. The peak demand is the difference between this base and the maximum amount of energy needed, usually during periods of extreme weather. Power plants that provide base energy are the most cost-effective, because they are run fairly constantly. "Peaker" power plants, on the other hand, can be run as little as 4 hours a day on a few very hot summer days, and the low duration of operation tends to result in higher co-pollutant emissions than their base counterparts on a per MW basis. Power plants are typically dispatched starting with the most efficient sources, which are generally also those with the lowest emissions. Under BAU conditions, many new power plants will need to be built in California to accommodate load growth and to replace the existing fleet of aging power

plants that have low efficiencies and relatively high co-pollutant emissions. There are also several coastal plants that could be closed in response to proposed environmental requirements for their once-through cooling systems (SWRCB 2010).

Power plants are typically located close to power recipients, suggesting that new power plants would most likely follow population growth in the state. Repowering old plants or constructing new plants in the South Coast, where the state's greatest demand is located, has been identified as particularly problematic due to the region's air quality constraints and permitting requirements.

Along with reliable power plants, important components of a reliable electricity system are distribution, transmission, and availability of fuel supplies. Like power plants, distribution systems are aging, and require substantial infrastructure investments to ensure their continued reliability. The construction of new transmission lines is needed to increase the state's renewable electricity sources to meet the existing statutory goals of 33 percent. If these goals are not met, the price of electricity could increase as utilities incur financial penalties. These issues have all been identified in the 2007 and 2009 Integrated Energy Policy Reports (IEPR) as high priorities for the state in the near term (CEC 2007; CEC 2009).

A third challenge is from the effects of climate change such as increasing frequency and magnitude of extreme weather events. This could drastically affect the duration and magnitude of peak demands, increasing reliance on aging power plants. During the summer months, California also imports energy generated by hydropower from the Northwest to meet peak demand. Decreasing snowpack within California and throughout the west is likely to reduce the availability of this clean and relatively inexpensive hydropower source, further exacerbating the problem. In addition, a large number of power plants in California are located along the coast. The potential for sea level rise associated with climate change could impact the operation of those plants.

The 2020 BAU greenhouse gas emissions forecast for the electric power sector is 110.4 $MMTCO_2E$. These emissions are the result of in-state power generation plus specified and unspecified imported power. BAU forecasted emissions assume that all growth in electricity demand by 2020 will be met by either unspecified imports or in-state natural gas-fired power plants. Measures that are already in place to reduce energy-generation and use emissions are the 20 Percent RPS and the energy efficiency program. The 33 Percent RPS was enacted by SB1X 2 and is expected to result in about 11.4 $MMTCO_2E$ in 2020.

The 2020 BAU forecast for emissions from specified sources of imported electricity (i.e., power received from specific out-of-state power plants) is assumed to decrease resulting from the closure of one coal-fired power plant previously supplying imported electricity. The demand previously served by the closed plant was replaced by in-state natural-gas generation. Based on outputs from the CEC electricity demand models, in-state electricity generation and specified imports would not meet the state's full electricity demand in 2020. The remaining demand is assumed to be met by

unspecified imported electricity (i.e., power received from a mix of power generating sources outside the state).

The Emissions Performance Standard (EPS) was established by SB 1368 (Perata, Chapter 598, Statutes of 2006), and will effectively reduce emissions from imported, coal-generated electricity. Regulations adopted pursuant to SB 1368 by the CPUC for investor-owned utilities and by the CEC for publicly-owned utilities prevent all California utilities from entering into long-term contracts that fail to meet an emissions performance standard. As existing agreements expire, coal-intensive electric utilities will need to respond to the established EPS with lower emission portfolios to maintain their California contracts. Such utilities will need to plan to replace coal-generated electricity with energy efficient, renewable and less carbon-intensive resources. ARB does not consider the EPS in the forecasted 2020 emissions. This allows the Scoping Plan reductions from increasing renewable power generation to be counted against with the BAU forecasted 2020 emissions without double-counting the reductions.

The California Public Utilities Commission (CPUC) recently promulgated a Decision to approve a settlement on CHP that had been negotiated by utilities and CHP proponents. The settlement requires investor owned utilities (IOUs), electrical service providers (ESPs), and community choice aggregators (CCAs) to reduce emissions from the electrical sector by retaining existing CHP and contracting with new CHP to secure a portion of the Scoping Plan's 6.7 MMTs of GHG reductions from CHP. The IOUs, ESPs, and CCAs have until 2020 to meet the Settlement's 4.8 MMTCO2E emission reduction target. One of the purposes of the settlement was to develop a method for CPUC jurisdictional utilities to achieve their portion of the Proposed Scoping Plan CHP measure. Additional CHP is expected from publicly owned utilities, but requires considerable analysis to determine what reductions are feasible. The electricity demand forecast in the 2011 Integrated Energy Policy Report being prepared by the California Energy Commission will include GHG reductions from CHP.

Electricity and Natural Gas in Residential and Commercial Properties

The Commercial and Residential sector is expected to contribute 45.3 $MMTCO_2E$ or about eight percent of the total statewide GHG emissions in 2020. Forecasted BAU emissions from the Commercial sector include combustion emissions from natural gas and other fuels (e.g., diesel) used by office buildings and small businesses. Residential emissions result primarily from natural gas combustion used for space heating and for hot water heaters. Growth in emissions from the Commercial and Residential sector is due primarily to the expected increase in population and assumed increased use of natural gas. Emissions from the use of other fuels, such as diesel fuel, are assumed to remain relatively constant over time.

Population growth in California will continue to increase electricity demand. The extent of the increase depends on natural gas used and the location of the users. Trends towards larger homes and increases in electronic equipment will also increase demand.

According to the Attorney General, since 2007, an unprecedented number of communities across the state implemented environmentally sensitive, or "green" building requirements to increase energy efficiency and decrease GHG emissions and other environmental impacts within their jurisdictions. In the first half of 2008 alone, nearly a dozen mandatory green building ordinances have taken effect, requiring private developers to utilize and document green building practices used throughout the construction and life of the project. Other California cities, like San Francisco, San Leandro, Santa Rosa, Hayward and Los Altos Hills are currently developing ordinances for enactment in the near future.

In January 2010, the California Building Standards Commission adopted the nation's first mandatory green building code. Called "CalGreen," the code became effective in early 2011 and lays out specific requirements for newly constructed buildings. It requires builders to install plumbing that cuts indoor water use by as much as 20 percent, to divert 50 percent of construction waste from landfills to recycling, and to use low-pollutant paints, carpets, and floors. It also mandates inspection of energy systems to ensure that heaters, air conditioners, and other mechanical equipment are working efficiently. For non-residential buildings, it requires the installation of water meters for different uses. The code also allows local jurisdictions to retain stricter green building standards, if they already exist, or to adopt stricter versions of the state code if they choose. The Scoping Plan encourages communities to adopt building codes that go beyond the state code (ARB 2009, pp. 57-59).

The experience of municipal actions and the adoption of the CalGreen building code have shown that bold, ambitious action to reduce carbon emissions is possible. These efforts have taken place without the Green Building measures being adopted as part of the Scoping Plan.

Water

Most of California's water supply originates and is stored as snow. The variability of annual precipitation, compounded by changing climatic conditions, can dramatically affect the availability of water from year to year. The allocation of water to satisfy competing urban, agricultural, and environmental interests represents a significant challenge for water managers. Notably, the allocation of water from the Colorado, Delta, and Klamath water supply systems has been subject to numerous legal challenges.

Water and energy are intricately linked. Water generates electricity, while electricity is required to distribute and treat water. In California, hydropower provides about 15 percent of the total electricity while approximately 19 percent of the state's electrical demand comes from transporting, treating and using water.

The California Water Plan is the State's strategic plan for management of water resources. The California Water Plan Update 2009 examined three scenarios extending to the year 2050: Current Trends, Slow & Strategic Growth, and Expansive Growth. The fundamental purpose of the water plan scenario analysis is to measure the

resiliency of future water policies and actions. The scenarios consider a range of key variables including population, land use, agricultural practices, environmental water needs, and climate change. Overall future water demand is projected to increase if California continues to grow consistent with current trends, but a slow and strategic approach to growth could reduce future water demand. (California Water Plan Update 2009. Volume1 Strategic Plan, pp. 5-22 to 5-36).

Long-term solutions to balancing California's water supply and use will require a combination of improved efficiency and use, conservation, and infrastructure improvements, none of which are anticipated to be completed by 2020.

Green Buildings

There are several policies, codes, and plans in place to increase the environmental efficiency of new and existing commercial, residential, and state buildings by 2020, including the new mandatory California Green Building Standards Code adopted by the Building Standards Commission adopted in January 2010, and made effective in early 2011. The California Public Utilities Commission (CPUC) also has established "zero net energy" (ZNE) goals for new construction in California. By 2020, the goal is that all new homes will be ZNE. For commercial buildings, the target date is 2030. In the best case, if the state is able to transform new housing and building stock into "net zero energy" stock, and existing buildings are retrofitted for greater energy and water efficiency, the demand for water and energy from buildings will be similar to or lower than what it is today. This will depend on both the degree to which new stock is built or existing stock is converted and the degree to which they incorporate environmental efficiency over the next twelve years.

Industry

The Industry Sector as defined in the Scoping Plan includes refineries, oil and gas facilities, cement and glass manufacturing, and industrial facilities that employ boilers or general combustion engines. The BAU assumptions for refineries are discussed in the transportation section above. Activity in California oil and gas fields are driven by price and availability, and may therefore expand in the future if current price trends continue. Off-shore drilling would most likely hold steady, due to the limited yield and potential for severe environmental impacts. While the demand for cement will grow with population growth, most of the demand is likely to be met through out of state production while the current rate of in-state production holds steady. Overall manufacturing is expected to slightly decline, while the commercial sector increases. Manufacturing will likely remain concentrated in the South Coast and Bay Area, with agricultural and food processing concentrated in the San Joaquin Valley.

Emissions for this sector are forecasted to grow to 91.5 $MMTCO_2E$ by 2020, an increase of approximately five percent from the average emissions level of 2002-2004. BAU-forecasted emissions for this sector are variable, but overall are not expected to grow substantially. Most of the growth from this sector comes from the fuel use and process emissions of three industries: cement plants, oil and gas production, and refining. Emissions from the combustion of natural gas are expected to grow for

some industries (e.g., cement plants) and decline for others (e.g., food processors). These assumptions of growth and decline in natural gas demand are based on outputs from energy demand modeling conducted by CEC staff for the 2009 Integrated Energy Policy Report (IEPR).

Recycling and Waste Management

California disposed an estimated 31 million tons of waste in landfills in 2009, which reflects a continuing decline from the state's peak of 42.5 million tons in 2005. Per capita waste disposal has also continued to decrease, most recently measured to be 4.5 pounds/resident/day in 2009, down from 5.1 pounds/resident/day in 2008 (CalRecycle 2010). The reduction in waste disposal reflects the state's high rate of waste diversion from landfills and the recession. Over 55 percent of California's waste is diverted from landfills and recycled or repurposed. Most of the remainder of California's waste is sent to landfills in the state. In the future, the need for new landfills will be determined by both population growth and by how well the state implements its waste management goals. One supporting goal is to halve the volume of organics going to landfills by 2020. These goals will require the development of new facilities for composting to recycle and reuse waste, but will also reduce the need for new landfill capacity.

Forecasted BAU emissions in 2020 for landfills are 8.5 $MMTCO_2E$. This forecast uses a recognized landfill gas emissions model developed by the Intergovernmental Panel on Climate Change (IPCC) and data from Cal Recycle. The forecast reflects assumptions regarding the continued decay of existing waste in landfills and estimates on the amount and character of new waste deposited in landfills through 2020.

Forests

The forest sector is unique to California's GHG inventory because it combines both positive and negative emissions into a current sink of approximately -5 $MMTCO_2E$ (2002-2004 average). This net number is negative because the annual gross emission rate from fires, decomposition, harvesting, land conversion, and wood waste is less than the atmospheric uptake of carbon dioxide from forest growth. In addition to being a GHG sink, forests also provide multiple ecological benefits like habitat, structure, and nutrient cycling, as well as a suite of other human benefits or services such as water storage, soil stability, air and water quality, wood products, and recreation. The BAU inventory shows that forest sector emissions are increasing while forest growth is remaining the same. Two factors addressed in the Proposed Scoping Plan which may cause a decline in forest carbon sinks over time, are land conversion and the increased incidence and intensity of wildfires.

As seen in summer of several recent years, wildfires can significantly impact air quality and threaten public safety. Wildfires in water supply watersheds can also impact drinking water quality for years after they occur. Population growth will increase pressure to develop forest lands and development in close vicinity of forests can further increase risk. Climate change is also likely to increase risks associated with the forest

sector through changes to weather patterns which can impact forests, both directly and indirectly, by creating hospitable conditions for pests and catastrophic fires.

High Global Warming Potential Gases

Consumer demand, vehicle use patterns, and increased electrical demand due to population growth will increase the amount of high-GWP gases released to the atmosphere. The rates of increase vary by type of activity.

The forecasted BAU 2020 emissions of high-GWP gases are 37.9 $MMTCO_2E$. High-GWP gases, including sulfur hexafluoride (SF_6) from electric utility applications, substitutes for ozone depleting substances (ODS) (primarily hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)), and other high-GWP gases used in semiconductor manufacturing and other industrial processes are combined under one sector for purposes of the Scoping Plan. The forecast of BAU emissions of high-GWP gases is derived from the U.S. EPA Vintaging Model, which outputs predicted annual consumption and emissions of all high GWP gases based on end-use equipment, the amount of gas required for manufacture and maintenance, and disposal emissions. Emissions of HFCs and PFCs as ODS-substitutes occur from their use in refrigeration and air conditioning systems, among other commercial and industrial applications. The high BAU forecasted emissions in 2020 comes about as ODS's are rapidly replaced by ODS substitutes, as more ODS's are phased out. In addition, ARB assumes that the effect of an expansion of the electrical transmission system infrastructure, combined with the technical improvements to the equipment in the system, will result in no net change in SF_6 emissions in 2020.

Agriculture

The agriculture sector includes emissions from livestock, i.e., digestive processes and manure management; combustion of liquid and gaseous fuels used for irrigation and crop production; emissions from fertilizer use and application of other soil additives; and emissions from agricultural residue burning. By 2020, there is significant potential for continued conversion of farmlands to urban, commercial, or industrial development or other uses.

Agricultural residue burning and livestock emissions were forecast using ARB’s criteria pollutant forecasting approach. Forecasted emissions from the combustion of natural gas were estimated using outputs from the 2007 IEPR developed by CEC. Other agriculture-related emissions were either held constant or extrapolated using historical trends to obtain a 2020 BAU estimate. BAU emissions from the agriculture sector are forecasted to increase about seven percent from current levels to 29.1 $MMTCO_2E$ in 2020, due exclusively to the assumed increase in livestock population. In spite of current measures to preserve farmlands and open space through Williamson Act contracts, state land purchase, and general plan land use designation or zoning, population increases will continue to pressure the conversion of farmlands to urban, commercial, and industrial development or other uses.

Summary of Alternative 1 Strategy

In summary, recognizing BAU estimates and the continuation of some GHG reduction programs already implemented as part of the Scoping Plan (e.g., pre-existing programs and discrete early action measures) or because of other legislative authorities (e.g., SB 375, SB1X 2), GHG emissions under the No-Project Alternative exceed the 2020 reduction goal in AB 32 by 22 $MMTCO_2E$. With this shortfall, the No-Project Alternative would be inconsistent with the AB 32 statutory mandate.

Alternative 1 Impact Discussion

Objectives

The No-Project Alternative would not meet the fundamental objective of the Scoping Plan and AB 32 to reach 2020 emissions goals, because the GHG emissions reductions of the existing programs and strategies authorized by other statutes would fall short of the mandated goal to of decreasing emissions to 1990 levels by 2020. The expected shortfall would be approximately 22 $MMTCO_2E$, because the Cap-and-Trade regulation and Advanced Clean Car program would not be a part of this alternative.

Environmental Impacts

The No-Project Alternative includes GHG reduction measures that are ongoing, already implemented as part of the Scoping Plan, or developed under authorities additional to AB 32. Direct and indirect environmental effects of these measures would result from implementation of the No-Project Alternative. This would include resource-related environmental effects associated with the development of renewable energy projects in response to the existing 33-percent RPS, including major utility-scale facilities in remote areas, and the construction and operation of the California high speed rail project being pursued by the High-Speed Rail Authority, which are the two existing measures that would result in the most substantial, landscape-altering construction projects. As a result, the No-Project Alternative would incur a substantial portion of the adverse environmental impacts of the Proposed Scoping Plan (which would add the Cap-and-Trade Program, including offset protocols, and the Advanced Clean Car program) without achieving comparable environmental benefits of reduced GHG and co-pollutant emissions. Consequently, the No-Project Alternative would not be environmentally advantageous, compared to the Proposed Scoping Plan.

Aesthetic impacts of the Proposed Scoping Plan, with its Cap-and-Trade Program and advanced clean car program, would be less than significant, because they would not involve substantial construction actions that would alter scenic resources or important views and vistas (ARB 2009, p. J-23). The No-Project Alternative would not avoid any significant aesthetic effects of the proposed programs. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential scenic resource and aesthetic impacts of developing utility-scale renewable energy projects, the high-speed rail project, or the million solar roofs program.

Agriculture and forest resources impacts of the Proposed Scoping Plan may be significant, because large-scale renewable energy facilities and the high-speed rail

project could affect agricultural land (ARB 2009, pp. J-41 – J-42). The sources of potentially significant adverse agricultural and forest resource impacts would not include a Cap-and-Trade Program and Advanced Clean Car program, because compliance responses would not involve use of agricultural lands or conversion of forest land to non-forest uses (ARB 2010b, p. O-15). The No-Project Alternative would not avoid any significant agricultural or forest conversion-related effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures of the Proposed Scoping Plan would continue to occur, such as potential conversion of important farmland related to developing utility-scale renewable energy projects or the high-speed rail project.

Air quality impacts of the Proposed Scoping Plan were identified as less than significant in the FED (ARB 2009, pp. J-24 – J-40) and included beneficial reduction of co-pollutant emissions on a statewide basis. Subsequently, the potential for significant localized air quality impact was further assessed for the Cap-and-Trade Regulation proposed in October 2008 (ARB 2010b, pp. O-15 – O-16). Localized air quality impacts resulting from compliance responses by covered entities and the development of offset credits related to that proposed Cap-and-Trade Regulation found impacts highly unlikely and the specific locations and impact of any such emission increases uncertain. To address the possibility of unanticipated localized air impacts caused by the Cap-and-Trade Regulation, ARB incorporated an adaptive management approach into the proposed regulation. The adaptive management approach reflects ARB's commitment to monitoring the data on localized air quality impacts and to adjusting a Cap-and-trade Regulation adopted, if warranted. Even with these considerations, ARB has took a conservative approach by concluding that the remote possibility of localized air impacts as potentially significant under CEQA. Therefore, the adoption of the No-Project Alternative would avoid this potentially significant, localized air quality effect of a Cap-and-Trade Program included in the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as construction-related or operational criteria pollutant emissions from the development of utility-scale renewable energy projects or the high-speed rail project. Also, environmental benefits related to statewide reduction in GHG emissions from the Cap-and-Trade Program and Advanced Clean Cars program, along with corresponding co-benefits of reductions in criteria air pollutants and TACs, would not be realized with the No-Project Alternative.

Biological impacts of the Proposed Scoping Plan would result from the Cap-and-Trade Program component, including compliance responses by covered entities and the development of offset credits (ARB 2009, pp. J-43 – J-45; ARB 2010b, p. O-16 and O-311 – O-314). These biological impacts would be potentially significant related to facility construction to reduce GHG emissions at existing facilities of cap-covered entities where natural resources could be present. Also, to the extent that new or modified fueling facilities for Advanced Clean Cars required construction on undeveloped land, additional landscape alteration may occur. Therefore, the adoption of the No-Project Alternative could avoid these potentially significant biological effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise

authorized measures of the Proposed Scoping Plan would continue to occur, such as LCFS and 33-percent RPS, which will require the siting and construction of facilities with potentially substantial alteration of natural landscapes. Substantial landscape alteration from the development of utility-scale renewable energy projects or the high-speed rail project could affect sensitive habitats and special-status species.

Cultural resources impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program, could involve potentially significant effects related to facility construction at existing facilities where archaeological or historic resources could be present (ARB 2009, p. J-46; ARB 2010b, p. O-17). This could include facilities constructed for purposes of reducing GHG at Cap-and-Trade Program covered entity locations and new or modified vehicle fueling stations for advanced clean cars. Therefore, the adoption of the No-Project Alternative would avoid these potentially significant cultural resources effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as the potential to disturb cultural resources from construction related to the development of utility-scale renewable energy projects or the high-speed rail project.

Energy impacts of the Proposed Scoping Plan with the Cap-and-Trade Program and Advanced Clean Car Program would be less than significant, because the programs would not require substantial net additional energy demand to implement. In addition, considering the energy efficiency improvements expected as a result of compliance responses, the lower GHG emission standards for motor vehicles, the use of renewable transportation fuels, beneficial reduction of energy consumption would occur with the Proposed Scoping Plan (ARB 2009, p. J-47 – J-48; ARB 2010b, p. O-17). Therefore, the adoption of the No-Project Alternative would not avoid any significant energy effects of the Proposed Scoping Plan and certain beneficial energy efficiency effects would not occur. The beneficial energy effects of other ongoing, implemented, or otherwise authorized measures, such as utility-scale renewable energy projects and the high-speed rail project, would not be realized.

Geological, soils, and mineral resources impacts of the Cap-and-Trade Program and Advanced Clean Car Program components of the proposed Scoping Plan could involve potentially significant effects related to facility construction at existing facilities where substantial earthwork would be required (ARB 2009, p. J-49 – J-50; ARB 2010b, p. O-17 – O-18). Therefore, the adoption of the No-Project Alternative would avoid these potentially significant effects of the proposed Scoping Plan to geology, soils, or mineral resources. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as from the potential for substantial grading and erosion from construction related to the development of utility-scale renewable energy projects or the high-speed rail project.

The GHG-related impacts of the Proposed Scoping Plan, including the Cap-and-Trade Regulation and Advanced Clean Car program, would be beneficial, because GHG reduction is the objective of the plan. Therefore, the adoption of the No-Project Alternative would not avoid any significant GHG effects of the Proposed Scoping Plan;

however, the beneficial GHG reduction effects of the Cap-and-Trade Program and Advanced Clean Car Program would not be realized. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential GHG benefits resulting from development of utility-scale renewable energy projects or the high-speed rail project.

Hazards and hazardous materials impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and an Advanced Clean Car Program, would be less than significant, because any waste stream from the programs would be handled by existing regulated handling and disposal requirements and new or more severe hazards would not result from facilities needed to implement the programs (ARB 2009, p. J-50 – J-54; ARB 2010b, p. O-18). The most substantial waste stream from the Scoping Plan programs would be spent batteries from the advanced clean car program. Battery recycling and disposal requirements would be included to minimize and properly handle hazardous materials in the battery waste stream. Therefore, the adoption of the No-Project Alternative would not avoid any potentially significant hazard or hazardous materials effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as the potential for accidental hazardous materials releases from major construction projects related to the development of utility-scale renewable energy projects or the high-speed rail project.

Hydrology and water quality impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program, could involve potentially significant effects related to construction of facilities for GHG reduction at Cap-and-Trade covered entity sites or related to new or modified fueling stations for advanced clean cars, where water resources are present (ARB 2009, p. J-64 – J-69; ARB 2010b, p. O-19). The effects could include alteration of drainage or accidental contaminant releases during construction. Therefore, the adoption of the No-Project Alternative would avoid these potentially significant effects of the Cap-and-Trade Program and Advanced Clean Car Program components of the Proposed Scoping Plan to hydrology and water quality. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as the potential for substantial drainage, flood hazard, and water quality effects from major construction projects related to the development of utility-scale renewable energy projects or the high-speed rail project.

Land use and planning impacts of the Proposed Scoping Plan with the Cap-and-Trade Program and Advanced Clean Car Program could involve potentially significant conflict with local plans and policies related to avoided conversion projects under the Forest Protocol of the Cap-and-Trade Program, where actions to protect a forest may conflict with locally adopted land use or development plans (ARB 2009, p. J-54 – J-57; ARB 2010b, p. O-19 – O-20 and O-322 – O-324). Therefore, the adoption of the No- Project Alternative would avoid this potentially significant land use plan conflict effect of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as the potential for

substantial land use and planning conflicts related to the development of utility-scale renewable energy projects or the high-speed rail project.

Noise impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program, could involve potentially significant effects related to construction and operational activities occurring as a result of installing livestock digesters under the proposed Cap-and-Trade Regulation offset protocol (ARB 2009, p. J-58 – J-59; ARB 2010b, p. O-20 and O-252 – O-256). Also, construction of new or modified fueling facilities for advanced clean cars could result in temporary, significant noise impacts, if facility locations are near sensitive receptors. Therefore, the adoption of the No-Project Alternative would avoid these potentially significant effects of the Proposed Scoping Plan to noise conditions. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as the potential for substantial noise generation related to the development of utility-scale renewable energy projects or development and operation of the high-speed rail project.

Employment, population, and housing impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program would be less than significant, because facility or operational changes at Cap-and-Trade covered entities or related to the Advanced Clean Car Program would not change socioeconomic conditions sufficiently to cause substantial physical environmental effects (ARB 2009, p. J-59 – J-60; ARB 2010b, p. O-20). In addition, considering the potential for facility improvements expected as a result of Cap-and-Trade Program, compliance responses, and an Advanced Clean Car Program, beneficial job generation would occur with these proposed programs (although not substantial enough in number to significantly affect local population or housing demands). Therefore, the adoption of the No-Project Alternative would not avoid any significant employment, population, or housing effects of the Proposed Scoping Plan and certain beneficial job formation effects would not occur. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential job forming benefits resulting from development of utility-scale renewable energy projects or the high-speed rail project.

Public service impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program, would be less than significant, because facility changes resulting from compliance responses would take place in areas already receiving community public services (ARB 2009, p. J-60 – J-61; ARB 2010b, p. O-21). Therefore, the adoption of the No-Project Alternative would not avoid any significant public services effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential public service demands resulting from development of utility-scale renewable energy projects (including remote-area emergency service demands when energy facilities are located substantially far from existing communities) or the high-speed rail project.

Recreation impacts of the Proposed Scoping Plan with the Cap-and-Trade Program and Advanced Clean Car program would be less than significant, because the location of

potential facility changes in response to these programs would not likely be near or in conflict with existing recreation areas or facilities (ARB 2009, p. J-61; ARB 2010b, p. O-21). Therefore, the adoption of the No-Project Alternative would not avoid any significant recreation effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential conflict with recreation resource lands from developing utility-scale renewable energy projects on public lands.

Transportation and traffic impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and advanced Clean Car Program, could involve potentially significant temporary effects related to construction activity traffic where substantial facility improvements are implemented as a compliance response (ARB 2009, p. J-63 – J-64; ARB 2010b, p. O-21 – O-22). Therefore, the adoption of the No-Project Alternative would avoid these potentially significant effects of the Proposed Scoping Plan to traffic conditions. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, however, such as the potential for substantial traffic generation during the construction phase of major, utility-scale renewable energy projects or the construction and operation of the high-speed rail project.

Utility and service system impacts of the Proposed Scoping Plan, including the Cap-and-Trade Program and Advanced Clean Car Program, would be less than significant, because facility changes resulting from compliance responses would take place in areas already receiving community utility services (ARB 2009, p. J-64; ARB 2010b, p. O-22). Therefore, the adoption of the No-Project Alternative would not avoid any significant utility and service system effects of the Proposed Scoping Plan. The effects of other ongoing, implemented, or otherwise authorized measures would continue to occur, such as potential utility or service system demands resulting from development of utility-scale renewable energy projects, including in remote areas, or the high-speed rail project.

2.4 Alternative 2: Adopt a Program Based on Cap-and-Trade for the Sectors Included in the Cap

Goal of Alternative 2

The goal of Alternative 2 is to consider an Alternative that focuses on a cap-and-trade program as the primary source of GHG emission reductions for the 22 MMT shortfall identified above. The intended advantage of a cap-and-trade program is that total GHG emissions decrease in compliance with a cap (i.e., allowable emission limit) that declines over time, while covered entities are afforded flexibility to pursue the most cost-effective actions to reduce emissions. In Alternative 2, the Advanced Clean Car Program is not included.

Role of Alternative 2 in the Range of Alternatives

The role of Alternative 2 in the range of alternatives is to assess the effectiveness and potential environmental effects of a GHG reduction approach where compliance relies more heavily on non-prescriptive measures that are adaptable to market and economic factors. A cap-and-trade program can involve many variations in the details of requirements for reporting, meeting surrender obligations, marketing tradable compliance allowances, and providing compliance flexibility with offsets. It is not feasible or meaningful to examine the very wide range of potential details for cap-and-trade programs, because the possible combinations of details are innumerable. However, describing a reasonable and practical approach to illustrate how a cap-and-trade program can reduce GHG emissions will enable an understanding of the relative potential of this market mechanism and its compliance responses to cause environmental impacts.

Precedents or Examples of the Approach in Alternative 2

Several precedents for cap-and-trade approaches have been reviewed while developing California's GHG emissions market-incentive program. Two federal market-incentive programs administered by the U.S. EPA provide a history of performance of cap-and-trade approaches to emissions reductions to consider. The two programs are directed at reducing NO_x emissions and acid rain. The South Coast Air Quality Management District (SCAQMD) has established a RECLAIM program for NO_x and SO_2 reduction. Two early GHG cap-and-trade programs are the Regional Greenhouse Gas Initiative (RGGI) in the Northeast United States and the European Union – Emissions Trading System (EU-ETS).

The Market Advisory Committee (MAC) established to help design the California cap-and-trade program recognized that the prior programs can provide lessons learned in their design and implementation. While not all features of the design of the prior programs worked well, like the absence of allowance banking in the RECLAIM program, the MAC report to ARB indicated that cap-and-trade had a strong potential to achieve GHG reductions in capped sectors at relatively low cost (MAC 2007, pp. 15-17). Independent evaluations of the effectiveness of cap-and-trade systems have identified both advantages and shortcomings from previous and ongoing programs. Some relevant conceptual studies are noted below, followed by a summary of precedential programs. The historic performance, both positive and negative, of market-incentive programs has provided guidance in the design of a California approach.

Conceptual Studies on Emissions Trading vs. Other Options

There is a vast literature that examines the pros and cons of cap-and-trade, and although authors vary in their conclusions, most agree that, if properly designed, cap-and-trade can be an effective tool for reducing emissions. This section presents a brief summary of recent studies on the fundamental considerations when selecting emissions trading as a policy tool.

In 2007, Resources for the Future released a report summarizing work conducted as part of an inter-industry U.S. Climate Policy Forum (RFF 2007). In addition to other topics, this report analyzed three general climate policy options: emissions trading, emissions taxes, and regulatory standards. With respect to carbon pricing policies, this report concludes the following key points:

- There are many similarities between CO_2 taxes and tradable allowances or permits. Both reduce emissions by associating a uniform price with emitting activities at any point in time, leading to efficient, low-cost emission reductions. Both can incorporate offset project opportunities and provide emissions leakage protection (through free allocation in the case of tradable permits or through rebates in the case of the tax).

- A predictable price, as imposed by a carbon tax, tends to have advantages over fixing the level of emissions through emissions trading for a short time horizon of several years. Over longer horizons fixed emissions targets through emissions trading become increasingly advantageous.

- The theoretical differences between a tax and trading policy are easily blurred in a hybrid emissions trading system where some allowances are auctioned to raise government revenue and where banking, borrowing or other flexible cost-containment mechanisms are in place to help stabilize prices.

- Traditional forms of regulation—technology and performance standards—represent an Alternative to emissions trading or CO_2 taxes, but can be much more costly because they do not allow the flexibility to shift efforts toward the cheapest mitigation opportunities. As a complement to emissions trading or CO_2 taxes, however, flexible standards can address possible additional market failures and potentially lower costs.

In February 2008, the U.S. Congressional Budget Office (CBO) released a study on policy options for reducing CO_2 emissions (CBO 2008). In this study, CBO compared three key criteria (i.e., efficiency, implementation, and international consistency considerations) for incentive-based approaches (i.e., CO_2 tax, cap with a ceiling and either banking or a price floor, cap with banking and either a circuit breaker or managed borrowing, and inflexible cap). The study explores ways in which policymakers could preserve the structure of a cap-and-trade program, but still achieve some of the advantages of a tax. These include setting a ceiling or a floor on the price of emission allowances, permitting firms to transfer emission-reduction requirements across time by banking allowances in one year for use in future years (or borrowing future allowances for use in an earlier year), and modifying the stringency of the cap from year to year on the basis of the price of allowances.

According to another study, published in the Oxford Review of Economic Policy in 2008 (Stavins 2008), the most efficient approach for the short to medium term in the U.S. in regards to addressing climate change would be a cap-and-trade system (also, see the study in the Harvard Environmental Law Review (Stavins 2007)). The study identifies

that the integrity of a domestic program could be maximized (and its costs and risks minimized) by:

- targeting all fossil-fuel-related CO_2 emissions through an upstream, economy-wide cap;
- setting a trajectory of caps over time that begins modestly and gradually becomes more stringent, establishing a long-run price signal to encourage investment;
- adopting mechanisms to protect against price uncertainty; and
- including linkages with the climate-policy action of other counties.

It is also stated that a well-designed, cap-and-trade system would minimize the costs of achieving any given emissions target through flexibility regarding how much a facility would emit and the ability to trade emission allowances. Also, the cost of achieving significant emission reductions in future years would depend on the availability and cost of low- or non-emitting technologies. A cap-and-trade system that establishes caps extending decades into the future provides important price signals and, hence, incentives for firms to invest in the development and deployment of such technologies, thereby lowering the future costs for achieving emission reductions. However, it is noted that a cap-and-trade system alone may not encourage the socially desirable level of investment in research, development, and deployment of new technologies that could reduce future emission-reduction costs and thus, to achieve this, additional policies may be necessary to provide targeted additional action.

Summary of Existing Emissions Trading Systems

NO_x Reduction Programs

From 1999 to 2002, the Ozone Transport Commission (OTC) NO_x Budget Program was implemented to reduce summertime NO_x emissions, which contribute to ozone formation, in the northeast United States. The program capped summertime NO_x emissions at 219,000 tons in 1999 and 143,000 tons in 2003, less than half of the 1990 baseline emission level of 490,000 tons. The OTC NO_x Budget Program used an allowance trading system that harnessed free market forces to reduce pollution. The NO_x Budget Trading Program (NBTP) replaced the OTC NO_x Budget Program in 2003. It was established as a market-based, cap-and-trade program created to reduce the regional transport of NO_x emissions from power plants and other large combustion sources that contribute to ozone nonattainment in the eastern United States. The program was a central component of the NO_x State Implementation Plan, otherwise known as “NOx SIP Call,” promulgated in 1998. All 20 states covered by the NO_x SIP Call were in the NBTP. In 2009, the Clean Air Interstate Rule’s ozone season program began, effectively replacing the NBTP in the East to achieve further summertime NO_x reductions from the power sector (U.S. EPA 2011b; U. S. EPA 2009, pp. 1-2).

Acid Rain Program

The overall goal of the Acid Rain Program was to achieve substantial environmental and public health benefits through reductions of SO_2 and NOx, which are the primary pollutants that cause acid rain. To achieve this goal at the lowest cost to society, the program employed both traditional and innovative, market-based approaches for controlling air pollution.

For SO_2 reduction, Title IV of the Clean Air Act set a goal of reducing annual emissions by 10 million tons below 1980 levels. To achieve these reductions, the law required a two-phase tightening of the restrictions placed on fossil fuel-fired power plants. Phase I began in 1995 and affected 263 units at 110 mostly coal-burning electric utility plants located in 21 Eastern and Midwestern states. An additional 182 units joined Phase I of the program as substitution or compensating units, bringing the total of Phase I affected units to 445. Emissions data indicate that 1995 SO_2 emissions at these units nationwide were reduced by almost 40 percent below their required level (U.S. EPA 2011).

Phase II of the SO_2 program, which began in the year 2000, lowered the annual emissions limits imposed on these large, higher emitting plants and also set restrictions on smaller, cleaner plants fired by coal, oil, and gas, encompassing over 2,000 units in all. The program affected existing utility units serving generators with an output capacity of greater than 25 megawatts and all new utility units.

The Clean Air Act also called for a 2 million ton reduction in NO_x emissions by the year 2000. A substantial portion of this reduction has been achieved by coal-fired utility boilers that have been required to install low NO_x burner technologies and to meet new emissions standards.

The Acid Rain Program was implemented through an integrated set of rules and guidance designed to accomplish three primary objectives: (1) achieve environmental benefits through reductions in SO_2 and NO_x emissions; (2) facilitate active trading of allowances and use of other compliance options to minimize compliance costs, maximize economic efficiency, and permit strong economic growth; and (3) promote pollution prevention and energy efficiency strategies and technologies. The program consisted of the following components (U.S .EPA 2011):

- The allowance trading system created low-cost rules of exchange that minimize government intrusion and make allowance trading a viable compliance strategy for reducing SO_2.
- The opt-in program allowed non-affected industrial and small utility units to participate in allowance trading.
- The NO_x emissions reduction rule set new NO_x emissions standards for existing coal-fired utility boilers and allowed emissions averaging to reduce costs.

- The permitting process afforded sources maximum flexibility in selecting the most cost-effective approach to reducing emissions.
- The continuous emission monitoring (CEM) requirements provided credible accounting of emissions to ensure the integrity of the market-based allowance system and to verify the achievement of the reduction goals.
- The excess emissions provision provided incentives to ensure self-enforcement, greatly reducing the need for government intervention.

SCAQMD RECLAIM Program

RECLAIM, the Regional Clean Air Incentives Market, is a multi-industry cap-and-trade program adopted by SCAQMD Governing Board in 1993. RECLAIM sets a factory-wide pollution limit for each covered business, and lets businesses decide what equipment, processes and materials they will use to meet their emission limits. Under RECLAIM, these allowable emission limits decline a specific amount each year for each covered factory. Companies are free to choose the most cost-effective, economical ways to reduce pollution. Companies that can reduce emissions more than required can then sell excess emission reductions to other firms. Buyers of the emission reduction credits are companies that need more time to clean up or find the cost of buying credits cheaper than buying and installing new equipment (SCAQMD 2007, pp. EX-1 – EX-2; SCAQMD 2011). The RECLAIM program required industries and businesses to cut their emissions by a specific amount each year, resulting in a 70 percent reduction for nitrogen oxides NO_x and a 60 percent reduction for SO_x by 2003. SO_x annual targets have been met every year. NO_x annual emissions have met the target every year except 2000 and 2001, when California experienced an energy shortage (SCAQMD 2007, p. EX-3; SCAQMD 2011).

On November 5, 2010, the Governing Board of the SCAQMD adopted amendments to its RECLAIM program that will result in cumulative reductions of 5.7 tons per day, or more than 51 percent reduction, of oxides of sulfur (SOx) from all RECLAIM facilities by 2019. The changes are to be implemented in phases: 3 tons per day in 2013, 4 tons per day in each year from 2014 through 2016, 5 tons per day in 2017 and 2018, and 5.7 tons per day in 2019 and beyond.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is the first market-based, regulatory program in the United States to focus on GHG emissions. Covered entities are limited to electricity generation facilities. Ten Northeastern and Mid-Atlantic states currently participate in the program. The Governor of New Jersey recently announced his intention to withdraw New Jersey from the program at the end of the first control period, December 31, 2011. The RGGI states have capped and committed to reduce CO_2 emissions from the power sector 10 percent by 2018. States sell nearly all emission allowances through auctions and invest proceeds in consumer benefits that include energy efficiency, renewable energy, and other clean energy technologies.

RGGI is composed of individual CO_2 Budget Trading Programs in each of the participating states. Through independent regulations, based on the RGGI Model Rule, each state's CO_2 Budget Trading Program limits emissions of CO_2 from electric power plants, issues CO_2 allowances, and establishes participation in regional CO_2 allowance auctions. Regulated power plants can use a CO_2 allowance issued by any of the participating states to demonstrate compliance with an individual state program. In this manner, the state programs, in aggregate, function as a single regional compliance market for CO_2 emissions (RGGI 2007).

European Union – Emissions Trading System

The European Union – Emissions Trading System (EU-ETS) cap-and-trade program was launched in 2005. Within the cap, companies receive emission allowances that they can sell to or buy from one another, as needed. The limit on the total number of available allowances supports their value. At the end of the trading period, each company must surrender enough allowances to cover all its emissions; otherwise, fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or sell them to another company that is short of allowances. The flexibility of trading promotes cost-effective reduction strategies. The number of allowances is reduced over time so that total emissions decrease. In 2020, emissions are planned to be 21 percent lower than in 2005.

The EU-ETS operates in 30 countries (the 27 EU Member States plus Iceland, Liechtenstein and Norway). It covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries, and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. Nitrous oxide emissions from certain processes are also covered. Between them, the installations currently in the scheme account for almost half of the EU's CO_2 emissions and 40 percent of its total GHG emissions.

Airlines are scheduled to join the system in 2012. The EU-ETS will be further expanded to the petrochemicals, ammonia, and aluminum industries and to additional gases in 2013, when the third trading period starts. Also, based on lessons learned during the first two trading periods, a series of system changes will be implemented (European Commission Climate Action 2011).

California Cap on GHG Emissions and Market-Based Compliance Mechanisms

The examples listed above are of existing cap-and-trade programs adopted by other entities. In developing Alternative 2, ARB staff also considered the work it has done in recent months as part of its proposal to the Board to adopt a Cap-and-Trade Regulation in California. As discussed above, the process is currently ongoing, and the Board has made no final decision on whether to adopt a Cap-and-Trade Regulation. Staff's recent work has, however, helped to inform the development and analysis of Alternative 2.

In 2010, ARB staff proposed the adoption of a Cap-and-Trade Regulation with fully developed strategies for defining the declining cap, emissions reporting, establishing

marketable emissions allowances, setting the timing for surrendering compliance instruments, formulating protocols for using carbon offsets, and creating an adaptive management approach. This program is described in detail in the FED for the California Cap on GHG Emissions and Market-Based Compliance Mechanisms regulation, released for public review in October 2010 (ARB 2010a, Appendix O). Relevant components of Alternative 2 are summarized from this Cap-and-Trade Regulation FED. Alternative 2, like the proposed Cap-and-Trade Regulation, includes use of offsets to achieve part of its reduction goals and help manage allowance prices. The applicable features of the Cap-and-Trade Regulation presented in that FED serve as the basis for the description in Alternative 2 (including the declining cap, a range of covered entities, requirements to surrender allowances at the end of compliance periods, and a commitment to adaptive management); however, Alternative 2 uses cap-and-trade to meet the entire 22 $MMTCO_2E$ shortfall from the AB 32 emissions goal identified above (rather than the 18 $MMTCO_2E$ target in the proposed regulation). The Cap-and-Trade rulemaking process is still underway and no final action to adopt the rule has been taken by ARB.

Independent Evaluations of Previous and Ongoing Cap-and-Trade Programs

As mentioned above, several trading programs exist in the U.S. and Europe and a broad spectrum of scientific, economic, legal and policy analyses of cap-and-trade programs have found that well designed and implemented programs for certain air pollutants have been effective (Burtraw and Swift 1996, Tietenberg 2006). The U.S. EPA's Acid Rain program is widely viewed as being very successful, bringing about large reductions for lower-than-expected costs. Specifically, the program resulted in cost savings of $1 billion annually, compared with costs under direct regulatory alternatives, and SO_2 emissions from the power sector decreased from 15.7 MT in 1990 to 10.2 MT in 2005 (Carlsom et al. 2000). Banking provisions contributed to the program's cost-effectiveness (Ellerman et al. 2000). Analyses of the program indicate that it did not produce unintended consequences of concentrating SO_2 emissions in minority communities, and improved air quality for minority and low-income populations (Ringquist, 2011: and U.S. EPA, 2005).

In the NO_x program, compliance cost savings of 40-47 percent have been estimated for the period 1999-2003, compared to a base case of continued command-and-control regulatory alternatives without trading or banking (Farrell et all 1999, as cited in Stavins 2008).

RECLAIM does not allow banking because of concerns that unacceptably high emissions would occur in a future year. The lack of banking is thought to have contributed to a substantial price spike for NO_x emission rights in 2000. Specifically, a heat wave caused an increase in demand for electricity, while the availability of imported power from other states declined. This increased demand was met by operating old-gas fired generating facilities in California that resulted in a significant rise in cost (i.e., tenfold) of RECLAIM trading credits and contributed to high wholesale electricity prices during that period (CBO 2008). Overall, trading under the RECLAIM

program was restricted in several ways, with some negative consequences, but despite these problems, NO_x and SO_x emissions in the regulated area were reduced significantly. The program reduced compliance costs for regulated facilities (i.e., 42 percent cost savings) (Anderson 1997).

The EU-ETS is a real-world example of a cap-and-trade system working in tandem with other complimentary climate policies (IIDRI, 2011). Creation of the EU-ETS was challenging (Convery, 2009); once the program was in place, several issues arose during implementation of the initial phase that involved member states relying on emission estimates rather than actual emissions as a result of insufficient historic data. This led to less stringent caps than anticipated, and the market price for allowances dropped significantly when the over-allocation became apparent (Grubb et al., 2011). The system overcame these start-up issues, and the EU-ETS now represents an example of a functioning CO_2 market achieving emissions reductions from sources covered by the program (Ellerman et al. 2010).

Attributes of Alternative 2

Alternative 2, like any cap-and-trade program, would need to undergo rigorous review during development of the regulation. For the purposes of this analysis, however, this Supplement will make certain assumptions about Alternative 2's attributes. Alternative 2 would cover the major sources of GHG emissions in the state, including refineries and power plants, industrial facilities and transportation fuels, which would include up to 85 percent of California's emissions. The program would impose an enforceable emissions cap that would steadily decline over time. The state would distribute allowances, which are tradable permits, equal to the cap. Sources under the cap would need to turn in allowances equal to their emissions at the end of each compliance period. Sources with more allowances than emissions can trade (i.e., sell) their surplus allowances to firms who find it more expensive to reduce their emissions than to purchase allowances from others. Alternative 2 would include a number of cost-containment strategies for smoothing the transition into the program, such as disturbing allowances for free in the early stages of the program, allowing those covered by the program to focus on investing in emission reductions and cleaner technologies, and limiting any concerns about competitiveness and emissions leakage.

Under the Alternative 2 cap-and-trade program, offset credits can be used by covered entities to meet a small portion of their compliance obligation. An offset is a credit that represents a reduction of GHGs resulting from an activity that can be measured, quantified, and verified. Each offset credit represents a metric ton of emission reductions from a source not directly covered by the cap-and-trade program.

The regulation would include strict rules for reporting emissions and trades, with substantial penalties for violations. Transparency in the trading process is important to avoid market manipulation.

Each design element is discussed in more detail later in this chapter.

Cap-and-Trade

In this Alternative 2 program, a cap that declines over time is placed on emissions from all covered sectors. The total number of allowances created would be equal to the cap set for cumulative emissions from all the covered sectors. In addition to allowances, a limited amount of offsets could be used for compliance. The use of offsets would allow emissions in the capped sectors to slightly exceed the allowances issued, though these additional emissions from capped sectors would be matched by emission reductions that result from offset projects. The term *compliance instrument* covers both allowances and offsets. Both types of compliance instruments may be traded among entities. At the end of each three year compliance period, covered entities are required to turn in, or *surrender*, enough compliance instruments to match their emissions during this time period. These compliance instruments are permanently retired, thereby reducing the allowable emissions under the cap over time. Each allowance equals one metric ton of carbon dioxide equivalent. Since the program includes some GHGs (e.g., methane) that are more effective at trapping heat than carbon dioxide, all emissions are measured in units relative to the heat trapping potential of carbon dioxide or CO_2E, the "E" standing for "equivalent".

Because a cap-and-trade program allows compliance instruments to be traded, the price for those instruments becomes a price on emitting carbon. This price provides incentives for GHG emission reductions and innovation. It can stimulate reductions for all covered sectors without requiring individual regulations for all GHG emissions. Pricing carbon in this way ultimately creates a market for finding the most cost-effective emission reductions. Providing entities the flexibility to find the most cost-effective reductions lowers the overall cost of the program. Creating a market provides more flexibility than direct regulation can and provides incentives for investment and deployment of low carbon technologies.

Fundamental Elements of the Cap-and-Trade Program

The following discussion highlights the basic elements of the Alternative 2 Cap-and-Trade Program. These elements closely follow the elements of the proposed Cap-and-Trade Program presented in the Proposed Scoping Plan. For Alternative 2, the targeted emissions reductions are 22 $MMTCO_2E$, instead of the 18 $MMTCO_2E$ target for the Proposed Scoping Plan.

Scope

The Cap-and-Trade Program phases sectors into the program. Under this phased approach, entities in the following sectors would be covered in the program according to the following timelines:

Starting in the first compliance period:

- Electricity generation, including electricity imported from outside California; and
- Large industrial sources with GHG emissions at or above 25,000 metric tons of carbon dioxide equivalent ($MTCO_2E$).

Starting in the second compliance period, the program expands to include fuel distributors in order to cover emissions associated with:

- Combustion of gasoline, diesel, natural gas, and propane from sources with emissions below 25,000 $MTCO_2E$, including all commercial, residential, and small industrial sources; and

- Fuels used for transportation.

All sectors listed above would be covered through 2020.

The Cap

The limit on GHG emissions, i.e., the cap, is a critical part of a Cap-and-Trade Program design because it determines the number of total allowances ARB would issue. The cap is set in the regulation and consists of annual cap numbers, also referred to as "budgets."

Based on the 2010 proposed program, the initial cap level would be set at the level of emissions expected from covered sources for that year, which, based on current projections would be 165.8 million $MTCO_2E$ ($MMTCO_2E$). The cap would decline starting in 2013 until 2015. In 2015 the cap would then be expanded to include GHG emissions from fuel suppliers. This expansion is based on the level of GHG emissions expected from the covered fuels for the year 2015, resulting in a cap for 2015 of 394.4 $MMTCO_2E$. The cap would then continue to decline from 2015 to 2020, to a level of about 334 $MMTCO_2E$.

The level of the cap is critical to the environmental effectiveness of a cap-and-trade program. If the cap is not set at a stringent enough level to drive GHG emission reduction activities, the environmental goals of the program may not be met even if all sources comply with program requirements. The intended design of such a program would be sufficiently stringent to motivate GHG emission reductions to achieve AB 32 goals. As discussed above, the cap in the Proposed Scoping Plan Cap-and-Trade Program would be about 334 $MMTCO_2E$ for 2020, which is designed to allow California to achieve the AB 32 target.

The cap is also an important element of the entire program design as it serves as a backstop for ensuring that the 2020 target is met. As the program covers about 85 percent of the emissions, any failure of the other measures will be addressed through compliance with this cap. This ability to serve as a flexible backstop to other policies is one of the most fundamental strengths of a cap-and-trade program.

Allowances

As discussed previously, an allowance is equal to one metric ton of CO_2E. ARB would issue a total of approximately 2.7 billion allowances for the Cap-and-Trade Regulation through the year 2020. This amount of allowances is about the same as the originally proposed Cap-and-Trade Regulation. Annual allowance budgets for calendar years 2012–2020 are established by regulation, so that the total number of allowances issued

in each year through 2020 are known. At the end of a compliance period, each covered entity is required to surrender allowances (and if it elects, a limited amount of offsets) equal to its total GHG emissions during that compliance period. ARB would also require entities to surrender compliance instruments to match a portion of their reported emissions each year during the three-year compliance period to reduce the risk of non-compliance at the end of the three year period. When compliance instruments are surrendered, ARB would permanently retire them.

Covered entities are not the only entities that may hold and trade allowances in the program. Entities in covered sectors with emissions less than 25,000 $MTCO_2E$ may voluntarily elect to become covered entities. Other non-covered entities may be eligible to participate voluntarily. Some examples of these non-covered entities include financial institutions or brokers, offset project developers, and those who may want to obtain and voluntarily retire allowances. Once an entity holds an allowance, it can: 1) surrender it to comply with an obligation under the regulation: 2) bank it for future use; 3) trade it to another entity; or 4) ask ARB to retire it.

A gradual transition into the program would occur through the design of the allocation system. As with the program identified in the Proposed Scoping Plan, ARB would rely primarily on free allocation at the start of the program to minimize near-term costs to California consumers and businesses and to minimize emissions leakage. The allocation design would reward those who have invested in energy efficiency and GHG emission reductions and would encourage continued investment in clean and efficient technologies in the future.

The outset of the program would include an auction that includes a consignment feature for allowances allocated to electricity distribution utilities. The auction would allow for broad participation by diverse market players and minimize the chances for manipulation. The auction is set up in a way to ensure that allowances go to those market participants that place the highest value on them.

Cost Containment Mechanisms

The Cap-and-Trade Regulation includes a number of mechanisms designed to minimize the costs of reducing GHGs without compromising the environmental integrity of the program. Some of the mechanisms in the proposed Cap-and-Trade Regulation are three-year compliance periods, banking, the Allowance Price Containment Reserve, offsets and linkage to other trading systems.

A number of major sources of California emissions are subject to significant year-to-year variations – for example, electricity sector emissions increase in low water years as lower hydropower production is replaced with natural gas generation. For this reason, the Alternative 2 program has been designed with a three-year compliance cycle to help smooth out these annual variations, and to provide sources with greater flexibility to reduce emissions.

In a cap-and-trade program, banking allows participants to hold spare allowances and use them for compliance in a later period. The ability to bank allowances provides an incentive for covered entities to make early reductions since the declining cap could push allowance prices higher over time. Staff proposes to allow banking of allowances without restriction.

Alternative 2 would include an Allowance Price Containment Reserve (the Reserve). The Reserve would be an account that is filled with a specified number of allowances removed from the overall cap at the beginning of the program. Covered entities may purchase reserve allowances at specified prices during direct quarterly sales. Covered entities gain flexibility through access to the Reserve if prices are high or entities expect prices to be high in the future.

Under the Alternative 2 program, covered entities may use offset credits to satisfy a small portion of their compliance obligation. In addition to providing compliance flexibility, the inclusion of offsets in the program would support the development of innovative projects and technologies from sources outside capped sectors that can play a key role in reducing emissions both inside and outside California.

Offsets must meet rigorous criteria that demonstrate that the emissions reductions are real, permanent, verifiable, enforceable, and quantifiable. To be credited as an offset, the action or project must also be additional to what is required by law or regulation or would otherwise have occurred. Under the Cap-and-Trade Program in Alternative 2, ARB would issue or recognize an offset credit that could be used by a covered entity instead of turning in an allowance for the equivalent amount of CO_2E emitted.

The Alternative 2 program imposes a limit on the amount of offsets that an individual covered entity can use for compliance. Allowing a limited number of offsets into the program provides benefits and ensures that some GHG emission reductions occur within the sectors covered by the Cap-and-Trade Program. The Alternative 2 Cap-and-Trade Program includes provisions that would allow a maximum of 232 million $MTCO_2E$ of offsets through the year 2020. This limit would be enforced through a limit on the use of offsets by an individual entity equal to eight percent of its compliance obligation. Combined with the Allowance Price Containment Reserve (described above), this limit ensures that a majority of reductions from the program come from sources covered by the program at expected allowance prices, while use of the reserve would relax that constraint if prices rise.

Linkage is the reciprocal acceptance of compliance instruments issued by another system. California could decide to link its Cap-and-Trade Program to other emissions trading systems of similar scope and rigor, and has been working with our WCI partners to create the framework for a regional system of linked programs. Linkage can expand the coverage of the Cap-and-Trade Program to include emission reduction opportunities for sources covered in another program. The proposed Cap-and-Trade Regulation establishes a framework for linkage. Each program considered for linkage would be subject to Board action, and would undergo a case-by-case analysis by staff as part of a formal rulemaking process.

Although linkage to any programs is not included in this alternative, three programs are candidates for future linkage. Currently three other WCI partners are working to implement cap-and-trade programs consistent with the Design for the WCI Regional Program by 2012 or 2013: British Columbia, Quebec, and Ontario. Linking to WCI partners would have several advantages for California. The reduction of GHG emissions that can be achieved collectively by the WCI partner jurisdictions are larger than what can be achieved through a California-only program. The broad scope of a WCI-wide market would provide additional opportunities for reduction of emissions, therefore providing greater market liquidity and more stable carbon prices within the program.

Compliance and Enforcement

A robust enforcement program would play a vital role in the success of a cap-and-trade program by discouraging gaming of the system and deter and punish fraudulent activities. One allowance is needed to cover one metric ton of a covered entity's emissions, if they are turned in by the compliance deadline. If an entity does not meet the compliance deadline it would need to surrender additional allowances. The Alternative 2 program would need to be designed to remove, to the extent possible, financial incentives for noncompliance and to make sure that every ton of GHG emitted is covered by a valid compliance instrument.

To develop an enforcement program for a cap-and-trade program, ARB staff could consult with legal and enforcement staffs from state and federal agencies to gain insight in this area. These agencies may include the California Environmental Protection Agency, California Attorney General's Office, the California Energy Commission, the California Public Utilities Commission, the Department of Water Resources, the United States Department of Justice, the United States Securities and Exchange Commission, and the United States Commodities and Futures Trading Commission. In addition, staff could consult with academic institutions, such as University of California Berkeley's Center for Law, Energy, and the Environment and legal and market expert scholars from other universities.

Adaptive Management

A cap-and-trade program would be made up of many elements and would serve a large number of important objectives at the same time. Accordingly, unanticipated effects and results could occur over the life of the Alternative 2 program. ARB, therefore, would be committed to using an adaptive management process to review and revise policies, protocols, and procedures as more information becomes available. Among other purposes, the adaptive management commitment would be useful in monitoring whether environmental impacts were arising and defining how a program could be modified to avoid or reduce them.

Summary of Alternative Strategy

Implementation of Alternative 2 would involve a strategy that is similar to the emphasis on a Cap-and-Trade Program in the Proposed Scoping Plan, except that the emissions reduction would need to account for 22 $MMTCO_2E$ to make up for the amount allocated

in the Scoping Plan for both Cap-and-Trade and Advanced Clean Cars. It would be expected to enable the state to reach its AB 32 goal by 2020, although the absence of the advanced clean car measure from this Alternative would place more GHG reduction burden on the market mechanisms of the Cap-and-Trade Program. As a result, allowance prices may be higher.

Alternative 2 Impact Discussion

Objectives

Alternative 2 would be expected to meet the fundamental objective of reaching the 2020 emissions reduction goal. The Proposed Scoping Plan Cap-and-Trade Program was designed to reduce GHG emissions by 18 $MMTCO_2E$. This Alternative is required to further reduce GHG emissions by 4 $MMTCO_2E$, because it must also account for the reduction assigned in implementation of the Proposed Scoping Plan to Advanced Clean Cars (4 $MMTCO_2E$). It would be reasonable to expect that the additional reduction could be achieved by more aggressive reductions within the existing covered entities and/or addition of other covered entities, because the cap establishes a firm emissions limit that must be met. Because reductions are not mandated for Advanced Clean Cars under this alternative, there would be less economic incentives for technological changes in that sector since emissions reduction may occur in any of the capped sectors.

The achievement of other objectives of the Proposed Scoping Plan would also be expected by Alternative 2, because a market-driven GHG reduction program has the characteristics sought by the objectives. For instance, it would reduce fossil fuel use through fuel switching compliance responses. Emissions reductions would be ensured by the establishment of the mandatory, declining cap. Reductions would be expected to occur in the most cost-effective manner, because the cost of reductions or the cost of allowances that can be purchased are determined by the market. Leakage would be minimized by the market-driven pricing of carbon and the availability of lower cost offsets for a portion of the reductions to help manage allowance prices. The allocation strategy would also include free allowances for trade-exposed industries. Many co-benefits would occur with an effective market-driven GHG reduction program, such as energy conservation and efficiency, reduced fossil fuels use, reduction of regional co-pollutants, and job-forming economic opportunities related to facility modifications and development of energy efficiency technologies.

Environmental Impacts

As described above, Alternative 2 focuses on a Cap-and-Trade Regulation and program designed to reduce GHG emissions sufficiently to achieve 22 $MMTCO_2E$ reductions by 2020, including compliance responses by covered entities and use of offsets according to specified protocols. Under this alternative, compliance responses by covered entities could include upgrading equipment, switching to lower intensity carbon fuels, implementing maintenance and process changes at existing facilities, and reducing operations of carbon-intense facilities in favor of increased operations of more carbon-efficient facilities. Implementation of carbon offset programs under specified

protocols could also occur. The four offset protocols proposed as part of the Proposed Scoping Plan's Cap-and-Trade Program would also be applicable for this alternative: Ozone Depleting Substances (ODS), Livestock, Urban Forest, and Forest. Construction-related activities associated with these compliance responses could occur. The general approach, covered entities, and offset protocols of a Cap-and-Trade Program under Alternative 2 would be reasonably expected to be similar to the Proposed Scoping Plan's Cap-and-Trade Program, except that the reduction target would be increased from 18 to 22 $MMTCO_2E$, because the reductions allocated in the Proposed Scoping Plan to the Advanced Clean Car program (4 $MMTCO_2E$ would also need to be covered) (ARB 2010b).

Aesthetic impacts of the Alternative 2 compliance responses of this Alternative would be less than significant, because they would not change the character of the facility sites. The ODS Offset Protocol would not introduce activities that would disrupt aesthetic or visual settings. The Livestock Offset Protocol would include the construction of digesters in agricultural settings. Digesters are consistent with agricultural uses and would not represent an adverse change to the visual character of the vicinity. The Urban Forest Offset Protocol would improve the quality of the urban visual environment and would be considered aesthetically beneficial. The Forest Offset Protocol would not increase the amount of forest activities, but could shift activities to projects that increase carbon sequestration. This shift could change the visual character of offset project sites over time, but would not pose an adverse visual impact. Managing forests to increase cover and remove dead and diseased trees may be a visually beneficial effect.

Agricultural and forest resources effects of Alternative 2's compliance responses would not be expected to affect agriculture or forest resources, because they would occur at existing facilities of the covered entities. The ODS Offset Protocol would not include activities that affect agriculture or forest resources. The Livestock Offset Protocol would include the construction of digesters in agricultural settings. Digesters are consistent with agricultural uses and would not represent an adverse change to agriculture or forest resources. The Urban Forest Offset Protocol would not affect agriculture or forest resources. The Forest Offset Protocol would not increase the amount of forest activities, but could shift activities to projects that increase carbon sequestration. Managing forests to increase cover and remove dead and diseased trees may be considered a beneficial impact to forests. The Forest Offset Protocol includes all existing mechanisms under current state law to limit clear cutting. Further, the Forest Offset Protocol does not include actions that would encourage the conversion of agricultural land to forest.

Air quality impacts of Alternative 2 would be mostly less than significant and would also include beneficial reduction of co-pollutant emissions on a statewide basis. However, a remote potential for significant localized air quality impact exists, as discussed below. This Alternative focuses on a cap-and-trade program designed to reduce GHG emissions sufficiently to achieve a 22 $MMTCO_2E$ reduction by 2020, including compliance responses by covered entities and use of offsets according to specified

protocols. In general, measures that reduce GHG emissions also provide co-benefits in terms of reductions in regional criteria air pollutant and TACs on a statewide basis, because of their similarities in source types. Thus, implementation of this Alternative would reduce statewide levels of criteria air pollutants and TACs resulting in a beneficial effect. Under this alternative, compliance responses by covered entities could include upgrading equipment, switching to lower intensity carbon fuels, implementing maintenance and process changes at existing facilities, and reducing operations of carbon-intense facilities in favor of increased operations of more carbon-efficient facilities

The combination of placing a price on carbon and setting a declining cap on emissions is expected to incentivize investment in more efficient processes and equipment, reducing criteria pollutant emissions and TACs. ARB staff evaluated the potential for criteria pollutant emissions increases under the proposed Cap-and-Trade Regulation in the Co-Pollutant Emissions Assessment (ARB, 2010a). The Assessment examined some hypothetical possibilities for potential increases in criteria pollutant emissions from certain facility types in four community-specific case studies and determined that any increase in co-pollutants is highly unlikely (ARB, 2010a).

Construction-related activities associated with these responses could adversely impact air quality due to the temporary generation of criteria air pollutants and TACs (e.g., use of diesel-fueled heavy-duty equipment and fugitive particulate matter dust emissions). Construction-related best management practices exist (e.g., watering) to reduce this potentially significant air quality impact. In addition, increasing operations of more carbon-efficient equipment could result in localized increases in emissions. For both of these potential impacts, the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Although localized air quality impacts resulting from compliance responses by covered entities and the development of offset credits related to Alternative 2 are highly unlikely, they cannot be entirely ruled out. For example, the use of compliance instruments (allowances and offsets) may result in an increase in actual emissions up to the permitted level of a facility. Also, the specific locations and impact of any such emission increases are uncertain. To address the possibility of unanticipated localized air impacts caused by the cap-and-trade program, ARB would incorporate an adaptive management program into the alternative. This means that ARB would be committed to monitoring the data on localized air quality impacts and to adjusting the program, if warranted. Even with these considerations, ARB has taken a conservative approach by concluding that the remote possibility of localized air impacts for Alternative 2 would be considered potentially significant and unavoidable under CEQA.

Biological resources may be affected by the compliance responses in Alternative 2. The upgrading of equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at covered facilities could affect natural habitats and sensitive species, if they are present around existing facilities. Construction, grading and trenching have the potential to adversely affect any protected biological resources that might exist at those locations. Recognized measures exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant impact may be unavoidable.

Biological effects of the offset protocols in Alternative 2 would vary, depending on the offset. The ODS Offset Protocol would not include activities that potentially affect biological resources. The Livestock Offset Protocol would include the construction of digesters at or adjacent to existing livestock operations where natural habitats are expected to be absent or limited. As such, the Livestock Offset Protocol would result in less than significant impacts to biological resources. The Urban Forest Offset Protocol recognizes tree improvement projects in urban settings, and as such would not be expected to significantly affect biological resources. The Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Reforestation projects conducted under the Forest Offset Protocol could change existing habitat and disrupt wildlife. Alternative 2 would include adaptive management to monitor and, where feasible, reduce this impact. The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, it is premature to be able to define project-level mitigation at the stage of programmatic analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that Alternative 2 may result in this potentially significant impact and it may be unavoidable.

Cultural resources may be adversely affected by construction related to the compliance responses under Alternative 2. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. Construction, grading and trenching have the potential to adversely impact any cultural resources that might exist at those locations. Recognized measures exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in

an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant impact may be unavoidable.

Cultural resources effects of the offset protocols in the Alternative would vary, depending on the offset. The ODS Offset Protocol would not include activities that potentially impact cultural resources. The Livestock Offset Protocol would include the construction of digesters at or adjacent to existing livestock operations where cultural or historic features could exist. Similarly, the Urban Forest Offset Protocol includes projects in urban settings where cultural and historic resources could exist. Although recognized mitigation measures exist to reduce these potential impacts, the authority to require project-specific mitigation lies with local permitting agencies and not ARB. Consequently, these impacts are conservatively identified as significant and unavoidable for purposes of CEQA compliance. The Forest Offset Protocol could change the type of forest projects that are undertaken, but would not alter the overall level of forest activities, and as such would not increase potential impacts to cultural resources. This impact of the Forest Offset Protocol would be less than significant.

Energy-related effects of Alternative 2 would be beneficial, because the GHG reduction strategy of cap-and-trade also results in improved energy efficiency and reductions in fossil fuel use. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes, all of which would be expected to improve energy efficiency. These actions would reduce overall energy demand and are considered beneficial effects. Projects implemented under the compliance offset protocols would not increase energy demand and, as such, pose no impacts or less than significant impacts to energy demand and use.

Geology, soils, and mineral resource effects could occur as a result of Alternative 2. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities, which could require construction of new facilities. Construction, grading and trenching have the potential to result in adverse soil erosion, dust generation, and sedimentation of local waterways. Recognized measures exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant impact may be unavoidable.

Geology, soils, and mineral resources impacts of the offset protocols in Alternative 2 would vary depending on the offset. The ODS Offset Protocol would pose no significant

impacts on geology, soils and mineral resources. The Livestock Offset Protocol would include the construction of digesters that would be subject to regulations considered sufficient to mitigate potential impact to geology, soils and mineral resources to a less than significant level. The Urban Forest Offset Protocol would result in only minor soil disturbance and would not be expected to adversely impact geology, soils or mineral resources. This impact would be less than significant. The Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Because the overall level of forest activities would not change, this impact would be less than significant.

GHG emission reduction is the goal of the Cap-and-Trade Program of Alternative 2, so its implementation would continue to improve GHG emissions conditions in the state. The existing condition of emissions (without GHG reduction measures) projected to 2020 is estimated to be 507 $MMTCO_2E$. The AB 32 emissions reduction target is 427 $MMTCO_2E$. Alternative 2 would need to reduce emissions by 22 $MMTCO_2E$ to contribute to reaching the target, i.e., the balance needed to reach the target if all of the other Proposed Scoping Plan measures achieve their expected reductions (except the advanced clean car program, which would not be included in the Alternative). Thus, GHG-related impacts of this Alternative would be beneficial because of the fundamental objective of this program to reduce GHGs. The potential for leakage is a consideration, but can be addressed in the design of cap-and-trade programs by incorporating offsets as well as through the fee allocation of allowances for sectors with a high risk of leakage.

Hazard and hazardous materials-related environmental impacts of Alternative 2 would be less than significant. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The use of hazardous materials is common practice in industrial settings. Implementation of compliance responses could include the use of hazardous materials, but this would be considered simply a continuation of existing business practices for the covered entities, controlled by existing practices and regulations, and, thus, considered less than significant. Offset projects implemented under the proposed offset protocols may result in the use or transport of hazardous materials that require special handling and disposal. All projects would be required to comply with established local, state, and federal laws pertaining to the use, storage, and transportation of these materials. Assuming compliance with applicable laws and regulations, the impacts would be less than significant.

Hydrology and water quality effects could occur as a result of Alternative 2. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. Construction, grading and trenching have the potential to result in adverse soil erosion resulting in sedimentation and degradation of local waterways. Recognized measures exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does

not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant impact may be unavoidable.

Hydrology and water quality effects of the offset protocols in Alternative 2 would vary depending on the offset. The ODS Offset Protocol would have no adverse impacts on hydrology and water quality. The Livestock Offset Protocol would include the construction of digesters that would be subject to regulations which are considered sufficient to mitigate potential impacts to hydrology and water quality to a less than significant level. The Urban Forest Offset Protocol would result in only minor soil disturbance resulting in less than significant impacts to hydrology or water quality. The Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Because the overall level of forest activities would not change, the potential to adversely impact hydrology and water quality would not change.

Land use impacts of the Alternative 2 compliance responses of this Alternative would be less than significant, because they would not change the fundamental use of facility sites. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities and, as such, would be consistent with the existing land use and would pose a less than significant land use and planning impact. The ODS Offset Protocol would use existing facilities, representing a less than significant impact to land use and planning. The Livestock Offset Protocol would allow the construction of digesters in agricultural settings. Digesters are an allowed use in agricultural areas. As such, their construction would not conflict with existing land use plans, and thus would be a less than significant impact. Projects implemented under the Urban Forest Offset Protocol would not conflict with land use plans, resulting in a less than significant impact.

Land use effects of the Forest Offset Protocol could occur as a result of avoided conversion projects that may conflict with local land use plans envisioning development or other uses of forested areas. The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact described as possible conflicts between the “avoided conversion” element of the Forest Offset Protocol and land use plans may be unavoidable.

Noise impacts of the compliance responses of the Alternative 2 covered entities and use of offsets would vary depending on the activity. Under this alternative, compliance

responses by covered entities could include upgrading equipment, switching to lower intensity carbon fuels, implementing maintenance and process changes at existing facilities, and reducing operations of carbon-intense facilities in favor of increased operations of more carbon-efficient facilities. Construction-related activities associated with these responses could adversely affect noise due to the generation of short-term levels that exceed acceptable ambient conditions (e.g., use of heavy-duty equipment). Construction-related best management practices currently exist (e.g., limiting activities to the less noise-sensitive daytime hours and maintaining equipment in proper working condition) to reduce this potentially significant noise impact. In addition, construction generated noise levels would be intermittent and temporary in nature and similar to the types of noise sources and associated levels that currently exist within these industrial settings.

With respect to potential operational increases, noise levels associated with increased carbon-efficient activities would likely be similar (in type and level) to those from existing carbon-intense and other activities that currently exist within these industrial settings. Thus, these impacts would be considered less than significant. However, under this alternative, the use of offsets according to specified protocols could result in both construction- and operational-related impacts due to the generation of noise levels that exceed ambient conditions at existing sensitive receptors. For example, a particular protocol could allow the construction of noise sources in non-industrial areas near sensitive receptors where sources of this nature do not currently exist. Best management practices currently exist (e.g., limiting construction activities to the less noise-sensitive daytime hours and obstructing the line of sight between sources and receptors for operational activities) to reduce this potentially significant noise impact.

The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Also, the specific locations and impact of any such noise increases are uncertain from protocols. Thus, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this noise impact would be considered potentially significant and unavoidable.

Adverse population, employment, and housing effects of Alternative 2, including the compliance responses and associated offset projects would not occur, because the compliance activities would not substantially change socioeconomic conditions. All impacts to population, employment, and housing would be less than significant.

Public services impacts of the Alternative 2 compliance responses of this Alternative would be less than significant, because these activities would occur at existing facility sites where public services are already provided. The Alternative 2 Cap-and-Trade Program, including the proposed compliance offset protocols and associated offset

projects would not result in increased demands for public services. All potential impacts to public services would be less than significant. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These projects would not substantially increase the level of public services beyond that already provided to existing facilities. The ODS Offset Protocol, the Livestock Offset Protocol, and the Urban Forest Protocol and associated projects would not result in a need for an increased level of public services beyond that already provided to existing facilities. The Forest Offset Protocol would not alter the extent of forest activities, but would shift some activities to projects that sequester carbon. Because the level of overall forest activities would not change, the consequential need for public services would not change. Thus, this public services impact is less than significant.

Recreation impacts of the Alternative 2 compliance responses of this Alternative would be less than significant, because these activities would occur at existing facility sites. The Alternative 2 Cap-and-Trade Program's expected compliance responses and associated offset projects would not result in increased demand for or adverse impacts to recreation resources. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These actions would have a less than significant impact on recreation resources. The ODS Offset Protocol, the Livestock Offset Protocol, the Urban Forest Offset Protocol, and associated offset projects would result in a less than significant impact on recreation resources. Forest management activities could disrupt opportunities for forest recreation, but such disruptions exist under current conditions. Offset projects developed under the proposed offset protocol would include the construction of roads, temporary closures for tree installation and periodic increases in truck or construction equipment traffic that could disrupt recreational activities, but forest projects developed under the Forest Offset Protocol would occur on land that was historically forested or currently forested, and consequently, the overall impact to recreational resources would be less than significant.

Transportation or traffic impacts from implementation of compliance responses under Alternative 2 would not be significant. Under this alternative, compliance responses by covered entities would not adversely impact transportation or traffic because any increases due to construction traffic would be temporary and mitigated through ingress and egress controls, traffic controls, and reduced speed zones to ensure safety; and operational traffic levels would be similar to existing conditions. Thus, these impacts would be considered less than significant. However, under this alternative, the use of offsets according to specified protocols could result in both construction- and operational-related impacts due the use of heavy-duty equipment on rural roads, potentially creating unsafe conditions, such as for construction of livestock digesters in rural areas. Best management practices exist to reduce this potentially significant impact. However, the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately

implemented to reduce the potentially significant impacts. Consequently, the FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant traffic impact may be unavoidable.

Utility and service system impacts of the Alternative 2 compliance responses of this Alternative would be less than significant, because these activities would occur at existing facility sites where utility systems are already provided. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These projects would not increase the level of utilities beyond that already provided to existing facilities. The availability and extension of utilities is subject to approval of the local utility provider, and readily implemented in a manner that would be less than significant. The ODS, Livestock, and Urban Forest offset protocols would not result in a demand for a significant increase in the level of utilities or service systems that may serve existing sites. Construction of new facilities could require the incidental extension of utilities and services. The availability and extension of utilities is subject to approval of the local utility provider, and thus mitigated to less than significant. The Forest Offset Protocol would not alter the extent of forest activities, but could increase forest projects to sequester carbon. Because the level of overall forest activities would not change, the consequential need for utility service systems associated with those activities would not change. Thus, this impact is considered less than significant.

2.5 Alternative 3: Adopt a Program Based on Source-Specific Regulatory Requirements with No Cap-and-Trade Component

Goal of Alternative 3

Instead of pursuing a cap-and-trade program or a carbon fee or other alternatives, ARB could pursue source-specific emissions limits by regulation to make up the emissions reductions that the Proposed Scoping Plan identifies as coming from Cap-and-Trade and Advanced Clean Car regulations (i.e., 22 $MMTCO_2E$). The goal of Alternative 3 is to evaluate this direct regulatory approach.

Role of Alternative 3 in the Range of Alternatives

Direct regulations typically establish performance-based limits on emissions, activities, or outputs at specified sources that are designed to achieve emission reductions in a cost-effective and technologically feasible manner. In some cases, a specific pollution abatement technology is required to achieve the emission reductions. In establishing source-specific limits, flexibility is often provided by using performance standards and allowing for such actions as averaging among individual units at different operations in complex facilities to improve the cost-effectiveness of the measure.

Direct regulations can be applied to a wide range of sources in different sectors. Example sectors include many types of industrial production operations, oil production

and refining, agriculture, electricity generation, ports, railyards, and transportation fuels, among others. For Alternative 3, sources have been selected to present a reasonable scenario for a potentially feasible strategy to help reach the 2020 reduction target. Different combinations of sources could also be defined; however, the definition of the Alternative below provides a reasoned analysis of the potential environmental effects of a direct, source-specific regulatory approach.

Precedents or Examples of the Approach in Alternative 3

California has a long history of developing, adopting, and successfully implementing source-specific air quality regulations. These regulations provide a broad range of potential approaches to consider in formulating Alternative 3. Both ARB and local air districts in California have extensive experience with regulating the wide variety of sources that emit smog-forming and toxic air emissions including cars, trucks, fuels, consumer products, agricultural sources, electricity generating facilities, and many types of industrial sources. Many of these sources also emit GHGs. Most of these regulations have been in the form of rules that focus on a specific sector such as automobiles, refineries, power plants, cement plants, gasoline, or consumer products, such as paint, deodorants, or hairspray.

Source-specific regulations have been widely used to regulate air emissions in the United States since the 1960's. Much of the progress in reducing levels of urban smog can be attributed to strong requirements to achieve specified emission reductions through the use of control equipment on cars, trucks, and industrial sources. ARB has largely pursued performance-based standards. These regulations specify a level of allowable emissions, but provide flexibility to regulated entities to choose the solutions that work best for their operations. ARB and the local air districts have most often pursued "intensity-based" regulations that require regulated entities to reduce the emissions associated with a given unit of output (e.g., the grams of pollution per mile for an automobile or pounds of emissions per KWh for electricity generation) instead of absolute limits on total emissions or activity. In some situations, limits are placed on the amount of emissions or other surrogates (e.g., hours of operation) to ensure there are no localized adverse effects.

Although intensity-based regulations do not provide a hard cap on emissions from a sector, they have been effective in reducing overall emissions despite growth in activity and, thus, improving air quality, even during periods of high economic growth. For example, although the number of miles driven by cars in California increased by 137 percent between 1980 and 2010, the smog-forming emissions from cars decreased by about 80 percent. In limited cases, ARB has adopted regulations that prescribe specific practices. For example, a measure to reduce hexavalent chromium for hard-chrome plating facilities has specific housekeeping measures to limit fugitive dust emissions.

Air agencies have also developed and implemented regulations to achieve reductions of emissions for complex sources that provide some degree of flexibility as to how those

reductions are achieved. These regulations generally apply to a specific sector or groups of larger sources, and incorporate an emission-related performance standard and, in some cases, an averaging and/or emission trading component. For example, the ARB's Low-Emission Vehicle regulations – designed to lower tailpipe emissions of smog-forming and other pollutants -- set a performance standard not for individual vehicles models, but for each manufacturer's fleet of cars. Manufacturers who outperformed the standard could bank the extra emission reductions for use in future years or sell to other manufacturers. Electric utilities have had to meet regional performance standards for NOx, but were provided with the flexibility to have different control levels at individual units so long as the regional standards were met. Other examples of flexible compliance mechanisms include the U.S. EPA acid rain trading program and SCAQMD RECLAIM program. See Alternative 2 for a discussion of these market-based programs.

The emissions of CO_2, the most common GHG, are somewhat unlike pollution that California has controlled successfully with direct regulation. Technology is available to control many other pollutants, but there is no device that can be placed at the top of a smokestack or converter that can be attached to a combustion engine to reduce or permanently capture the most common GHG – carbon dioxide. Carbon capture and storage is developing as a technology, but it has yet to be proven as a cost-effective, viable GHG reduction technology (IPCC 2005, p. 8). Most of the potential GHG emission reductions available from direct regulation of existing industrial sources are based on approaches that, in one way or another, result in reduced combustion of fossil fuels, such as energy efficiency improvements or building new renewable generation (thus reducing overall electricity demand including fossil-fueled generation); switching fuel supplies (e.g., from coal, a much more carbon-intensive fuel, to natural gas or from using oil to biofuels); or reducing fugitive or process emissions, for example, from natural gas extraction processes or pipelines.

Attributes of Alternative 3

Because a very wide range of potential direct regulations could be adopted to reduce GHG emissions in regulated sectors, it would not be feasible to consider all the possible combinations. The description that follows presents the process for identifying regulatory measures and a reasonable scenario for a potential direct regulatory approach to GHG emissions reduction in California.

Regulatory Development, Implementation and Enforcement

Regulatory development typically begins with staff researching potential control technologies at all stages of development – from systems that have been deployed in the field to technologies that are still in the research phase. Regulatory staff evaluates the industries that are candidates for regulation to understand their operations. This helps them determine how control technologies or methods could be integrated and gain a better understanding of potential barriers to implementation. For example, if a packinghouse uses loading equipment around the clock, battery-operated equipment that requires extended recharging time each day may not be feasible. Staff must also

consider how regulations would affect other essential systems. For example, requiring the least efficient power plants to cease operation could reduce the reliability of the electricity grid.

If ARB pursues direct regulations to implement AB 32, each regulation would go through the rigorous Administrative Procedure Act (APA) process. The APA provides very specific rules for adopting new regulations. This process must be completed within one year of the notice date (see below), pursuant to Government Code section 11346.4(b). Information about the APA process is presented in Section 2.2 above. In addition, any GHG measure adopted under the authority of AB 32 has additional, specific statutory requirements that must be met.

The ultimate staff regulatory proposal depends upon an extensive knowledge of where emissions come from, the potential means to reduce emissions, the feasibility and cost of these technologies, environmental impacts of compliance responses, and how each industry operates to assess whether the proposal is workable. Staff proposals are vetted in public workshops to provide opportunities for the public and the potential affected industry to both provide additional information, identify alternatives and to comment on the staff's proposal. Proposed regulations also undergo environmental review consistent with ARB's certified regulatory program under CEQA. For ARB, regulations are proposed to the Board for consideration and adoption. Following Board adoption, regulations are transmitted to the Office of Administrative Law for entry into the California Code of Regulations, at which time they become law.

Once regulations are adopted and become law, ARB transitions to implementation and enforcement. The approach to implementation and enforcement depends upon both the type of regulation and the sources affected. Regulations that apply to a small number of vehicle or engine manufacturers can usually be implemented and enforced with fewer resources than regulations that apply to thousands of equipment owners and operators.

Description of Alternative 3

Alternative 3 has been designed to identify additional measures that use direct regulations that could achieve another 22 $MMTCO_2E$ reductions by 2020 to cover the shortfall necessary to meet the emission target required by AB 32. To develop Alternative 3, ARB assessed the sources of remaining GHG emissions in 2020 and considered potential source-specific reduction opportunities in the major sectors. It should be noted that the measures needed for Alternative 3 are in addition to many performance-based approaches that are already included in the No-Project Alternative. ARB based this evaluation on a number of studies including the compliance pathway analysis in the Initial Statement of Reasons for the Cap-and-Trade Regulation (ARB 2010a), the draft Scoping Plan (ARB 2008) which outlined a number of potential source-specific measures that were not ultimately included in the 2008 Scoping Plan (ARB 2009), suggestions from the public, and ARB staff's knowledge about emission sources and current and emerging control technologies. The potential reductions estimated in this analysis are generally based on those typically found in the United

States. These estimates should be considered a conservatively high estimate, because California sources are typically more efficient than national counterparts.

To identify sources for a direct regulation, an analysis of candidate sectors was undertaken to identify the potentially feasible sources that could be subject to direct regulation. Based on the analysis of the multiple sectors presented below, three specific sectors were chosen as the focus of Alternative 3. These sectors are: coal-fired electricity generation, three industrial sectors (refineries, cement, and oil and gas extraction), and advanced clean cars in the transportation sector. These sectors were also generally chosen based on their potential for reductions in criteria pollutants and TACs, along with local benefits. The analysis below shows that direct regulation of these sectors may be technologically feasible, but substantial additional analysis would need to be done to ensure that the APA and AB 32 requirements could be met.

Transportation

Transportation is the largest source of GHG emissions in California. This sector includes the GHG emitted when transportation fuels, predominantly gasoline and diesel fuel, are burned in car, truck and off-road engines to move both people and freight. This sector is estimated to emit 184 MMTs of GHGs in 2020 in the revised baseline forecast, which includes the clean car standards already adopted by ARB. The current estimate is that, excluding reductions that might occur with a Cap-and-Trade Program in place, this sector's emissions will be reduced by about 24 $MMTCO_2E$, to approximately 160 $MMTCO_2E$ by 2020 through programs such as Low Carbon Fuel Standard (LCFS), GHG emission reductions targets under SB 375 (Chap. 728, Statutes of 2008) and strengthening of the clean cars standards for new vehicles produced between 2017 and 2020.

GHG emissions in the transportation sector can be reduced in three primary ways: by reducing the GHG emissions emitted by vehicles and off-road engines; by reducing the carbon intensity of the fuel burned in these vehicles and engines; and by reducing the need to use these vehicles and off-road engines. As stated above, ARB has already adopted source-specific regulations or is pursuing programs in all three of these arenas. ARB has adopted limits on the GHG emissions from passenger vehicles. Similar limits have also been adopted by the federal government and the California and federal programs are aligned through 2016. ARB has also adopted and is implementing the LCFS to reduce the carbon intensity of transportation fuel by 10 percent by 2020. In addition, under SB 375, ARB has set GHG emission reduction targets for passenger vehicles for 2020 and 2035. These targets mark the first step toward a statewide program to integrate long-range land use, housing, and transportation planning at the regional level, which is designed to reduce travel by cars and light trucks.

The compliance pathway analysis prepared in 2010 notes that the transportation sector offers the potential for low-cost emission reductions (ARB 2010a). However, it is unlikely that substantial additional emission reductions could be realized from the transportation sector by 2020 by adopting additional traditional regulations other than those already in the Proposed Scoping Plan. Under the Advanced Clean Car Program,

ARB is already pursuing additional rulemaking to further reduce GHG emissions from passenger vehicles produced in the 2017 to 2020 period. The Advanced Clean Car Program is currently under development, with the Board anticipated to consider the regulation in late 2011. Based on adjustment of the estimate in the Proposed Scoping Plan, ARB has estimated 3.8 $MMTCO_2E$ of "foreseeable" emission reductions from this measure. The Advanced Clean Car Program is also expected to achieve significant reductions in criteria pollutants and TACs. For all of these reasons, the Advanced Clean Car Program is included in Alternative 3.

As discussed above, the LCFS requires fuel providers to achieve a 10 percent reduction in the carbon intensity of transportation fuels by 2020. This is an ambitious target and the rule itself calls for periodic reviews to determine if adjustments in the emission reduction targets are needed. The first comprehensive review is now underway, but will not be completed until the end of 2011. It is possible that sufficient low carbon fuels will be available by 2020 to enable additional reductions to be achieved, but it is uncertain at this time. Thus, it is not feasible at this time to target additional emission reductions from this source category.

Electricity

Electricity generation, both within California and from sources that import electricity into the state, are a significant source of GHG emissions. The current estimate is that, excluding reductions that might occur under a Cap-and-Trade Program, this sector's emissions will be reduced by about 20 MMTs by 2020 through programs such as the 33-percent RPS (authorized by SB1X 2, Statutes of 2011) and expansion of energy efficiency efforts. The remaining emissions, would be expected to come from a combination of in- and out-of-state natural gas fired generation and out-of-state coal fired generation (approximately 90 MMTs).

There are four primary methods to reduce emissions from the electricity sector: (1) expanding the use of renewable generation and cogeneration technologies, (2) improving the efficiency of existing electricity generating facilities, (3) using electricity more efficiently, and (4) switching to lower-carbon fuels in those sources that use higher-carbon, fossil fuels to generate electricity.

Relative to expanded use of low GHG emitting renewable technologies, the No-Project Alternative already relies upon the further reduction of the electricity sector's carbon footprint with a requirement that by 2020, 33 percent of the electricity delivered to retail customers come from renewable sources, such as wind, geothermal, biomass, and solar. This measure, which was originally approved as an ARB rule in 2010, has recently been enacted into law (SB1X 2, Statutes of 2011). Requirements for a higher percentage of renewable generation could be estimated. For example, a requirement could be established that 40 percent of the delivered electricity should come from renewable sources. This higher requirement could potentially result in an additional reduction of 6 $MMTCO_2E$ by 2020. However, this requirement was not recommended for inclusion in Alternative 3. The underlying basis and rationale for such a standard

would need to be considered as part of an overall policy strategy on energy and would not likely be cost-effective from simply a GHG-reduction perspective.

Existing electricity generating facilities in California vary in age and efficiency. The primary methods to significantly reduce GHG emissions from older, inefficient existing facilities are to "re-power" them with a new unit at the existing site, or to retire them and replace their generation with a new facility at another location. Grid reliability is a critical issue that must be thoroughly evaluated in determining which facilities can be retired or re-powered.

Existing programs and regulations, as described in the No-Project Alternative, include substantial GHG reductions from increasing efficiency in the use of electricity and natural gas. The No-Project Alternative assumes that all cost-effective energy efficiency measures are implemented by 2020, although the specific methods are not identified. California law and existing policy require that energy efficiency codes and standards must be cost-effective. Achieving additional GHG emission reductions through energy efficiency beyond those already assumed in the No-Project Alternative is highly unlikely.

Fuel switching to reduce GHG emissions often refers to replacing high carbon fuels, such as coal, with lower carbon fuels, such as natural gas. In California, the vast majority of electricity generating facilities already operate on natural gas. The major opportunity for lower emissions from fuel switching is with in-state and out-of-state, coal-fired units. California's existing Emissions Performance Standard (EPS) (Senate Bill 1368, Perata, Chapter 598, Statutes of 2006) prevents the state's electric utilities from entering into new or extending existing long-term contracts with high-emissions intensity sources, such as coal.

Because electricity from existing coal-fired power plants is very inexpensive to produce, regulations to directly reduce use of coal-generated electricity in California could result in significant leakage, with the out-of-state electricity now used by California being sold in other markets. This switch from coal to gas-fired generation would be effective in reducing greenhouse gas emissions only if existing coal generation is retired as California consumed less of their production, or if the operation was curtailed though some other means. However, despite the potential drawbacks, a regulation to further curtail dependence on coal-fired generation is technically feasible and, of the available options, the most likely measure to gain significant reductions from the electricity sector in California's GHG emission inventory via source-specific regulation. Estimates of these potential emission reductions are provided in the section titled, Summary of Alternative 3 Strategy.

Industrial Sources

Industrial sources account for almost 20 percent of GHG emissions in California. This sector is estimated to emit approximately 92 MMTs of GHGs in 2020 in the revised baseline forecast. Based on the analysis presented below, there are three industrial source categories where direct regulation is feasible. These are refineries, oil and gas extraction, and cement. Consequently, Alternative 3 would entail development of direct

regulations to obtain GHG emission reductions from these three specified industrial sources. Estimates of the potential emission reductions from the direct regulation of these sectors are presented in the section titled, Summary of Alternative 3 Strategy.

The industrial sector is composed of four large discrete sectors and one additional general sector. The largest discrete sectors, in terms of emissions in the 2020 baseline, include refining (35 MMTs), oil and gas extraction (16 MMTs), cogeneration related sources (10 MMTs) and cement production (9 MMTs), each with its own unique operating characteristics. Within some sectors, there may be significant variation in the types and size of sources. For example, refineries are individually designed to process specific types of crude oil into the desired transportation fuels. The last large sector, industrial combustion (15 MMTs), is composed of smaller sub-sectors, many with unique needs and operating characteristics.

Generally, there are no devices that can be placed at the top of a smokestack to reduce or permanently capture the most common GHG, i.e., carbon dioxide, from industrial sources. Most of the potential reductions available from industrial sources with combustion emissions are based improving energy efficiency, switching fuel supplies, or limiting the output of the units to maintain a specified emission level.

The compliance pathway analysis estimated approximately 5 MMTs of potential emission reductions from the industrial sector ranging in price from savings of $100 per metric ton to costs of greater than $200 per metric ton (ARB 2010a, Figure V-5). For boilers and other heat sources, low-cost or cost-saving strategies included maintenance strategies such as steam leak and steam trap maintenance generated cost savings, and high-cost strategies included process heater and boiler replacement. Developing a regulation to require certain types or schedules for maintenance would be administratively challenging. Because operating characteristics and requirements vary significantly across (and within) industries, ARB would likely be unable to prescribe a uniform maintenance schedule, but could develop specific maintenance practices for a multitude of applications. Implementation and enforcement of such a regulation would be extremely resource-intensive requiring site visits to hundreds of industrial facilities. Although there is substantial variation in boiler age, size and operating conditions, it would also be feasible to develop a regulation to mandate improved efficiency from existing industrial boilers, for example a boiler performance standard. The results from ARB's Energy Efficiency and Co-Benefits Assessment will be available in mid-2012, and would allow ARB staff to better evaluate the feasibility, cost, and cost-effectiveness of industrial boiler regulations.

A discussion of specific subsectors follows:

Refineries

A number of refinery-specific measures to reduce GHG emissions are possible. Such measures include process level or industry-wide performance standards, adding gas recovery at refinery flares, removing the methane exemption from determining if a leak is significant and needs to be addressed, and capping GHG emissions from

refineries. Though most large California refineries make similar products and have many common processes, the age, efficiency, state of upgrade, crude oil mix and potential cost and cost-effectiveness of modifications vary widely. While this presents potentially significant challenges for the development of process-level or industry-wide performance standards, such regulations may be feasible. Enhancing gas recovery capacity at flares and removal of the methane exemption in refinery leak-detection and repair regulations were included as Scoping Plan measures. However, ARB's preliminary evaluation indicates that emissions from flaring are lower than originally estimated, there are existing and effective measures in place at each of the three local air districts where major refineries are located, and the potential for reductions from these measures appear to be very small. ARB could establish a cap on GHG emissions for individual refineries. This approach would likely afford each source the greatest flexibility to meet its emission obligation relative to other direct regulation approaches. In addition, a refinery cap would likely provide co-benefits of reducing criteria pollutants and TACs. However, if a cap is set too low, some refineries may be induced to curtail output rather than invest in energy efficiency modifications. While this would reduce in-state GHG emissions, it might also reduce in-state production of transportation fuels, and result in out-of-state refineries needing to increase production to meet demand.

Cement Plants

The strategies to reduce GHG emissions from cement plants address the two sources of GHG emissions from cement facilities – coal combustion and the process emissions associated with calcinating the limestone to make cement. Blending of cement with supplementary cementitious materials (SCMs) would "stretch" the cement supply, reducing the need for imported cement. However, requiring the use of SCMs is unlikely to reduce direct GHG emissions from cement manufacturing within California since it occurs downstream from the production facility. ARB has explored the idea of a cement carbon intensity factor (CIF) which would assign a CIF performance standard that accounts for the fuel used to produce a given amount of cement. In order to meet the performance standard, cement plants would need to replace a portion of their coal with Alternative fuels such as natural gas or biomass. Each of these Alternative fuels presents implementation challenges from cost and fuel infrastructure (natural gas) to supply and availability (biomass).

Additional costs from the Alternative are likely to result in increased emissions leakage (such as from increased production in China). The cement industry is highly capital intensive and because of high fixed costs, facilities must operate at high capacity levels to maximize return on investment. If they cannot do so, an increase in imports from other countries is the most likely outcome. California's plants are among the lowest GHG-emitting facilities in the world. Any leakage would result in an increase in GHG emissions.

However, as with refineries, a cap on GHG emissions could be set for each individual cement facility. Such an approach would afford each facility the greatest flexibility to meet its emission obligation; however, if set too low, such a cap could induce some facilities to curtail output, rather than invest in energy efficiency modifications or make

fuel changes. As with refineries, a cap would likely provide co-benefits of reducing criteria pollutants and TACs. While a cap would reduce in-state GHG emissions, it would also reduce in-state production of cement, and could result in an increase of out-of-state facilities' output to meet California demand, causing substantial leakage.

Cogeneration

Cogeneration systems produce both electricity and useful heat for industrial or heating purposes. Cogeneration is widely used in California, but has the potential to significantly expand. Sometimes referred to as combined heat and power (CHP), cogeneration can reduce GHG emissions by displacing emissions from power plants. It often improves grid reliability, reduces dependence on transmission lines, and reduces electrical transmission and distribution energy loss. However, barriers have limited the recent growth of cogeneration, such as the reluctance of utilities to accept power from sources they do not control, the charging of fees even though electricity is not consumed (i.e., standby charges or interconnection fees), and the lack of a sufficient market price for electricity generated onsite. Because of actions taken by the CPUC, the expansion of CHP for investor-owned utilities (IOUs) is anticipated in the No-Project Alternative. Additional CHP may be an option for publicly owned utilities (POUs), but requires considerable analysis to determine if reductions are feasible.

Progress has been made recently to encourage the development and installation of efficient CHP. The CPUC has approved a settlement that establishes a CHP Program designed to preserve resource diversity, fuel efficiency, GHG emission reductions, and other benefits and contributions of CHP. However, the settlement is not yet final. Through July 17, 2015, a large portion of the GHG emission reduction benefits of the existing CHP fleet will be retained through the procurement of approximately 3,000 MW of existing CHP. Consistent with the 2008 Scoping Plan, the CHP Program also establishes an incremental GHG emission reduction target of 4.8 MMTCO2E for the IOUs, ESPs, and CCAs that will require the installation of approximately 3,000 MW of new CHP by 2020. The Settlement assumes the remainder of the Scoping Plan's CHP emission reductions will come from the installation of new CHP systems at POUs to achieve the Scoping Plan's 6.7 MMTCO2E of emission reductions due to the installation of 4,000 MW of new CHP.

Oil and Gas Extraction

The oil and gas extraction sector has emissions that result from combustion and venting operations, as well as fugitive emissions. Over 80 percent of the emissions are associated with combustion, with the vast majority using natural gas as the fuel.

The 2008 Scoping Plan included a measure to reduce GHG emissions that are either vented or are fugitive emissions from oil and gas extraction operations. ARB evaluation of this measure found that the emissions from this category were underestimated in the 2008 Scoping Plan. Staff now estimates that emission reductions of about 1 MMT could be feasibly achieved from this measure; however, the cost-effectiveness and feasibility of a potential regulation have not yet been fully evaluated.

Given the large emissions from this category and the fact that there are a significant number of large operations, there is also potential to apply facility-level emission caps. Such an approach would afford each facility the greatest flexibility to meet its emission obligation; although, if set too low, such a cap could induce some facilities to curtail production, rather than invest in energy efficiency modifications or improving operations in other ways. Presumably lost production would be replaced by greater imports of crude oil and natural gas, and GHG emissions would increase in the area where these supplies were extracted (i.e., emissions leakage). Consequently, while additional GHG reductions from direct regulation of oil and gas extraction facilities may occur, leakage risk could be high.

Commercial and Residential Fuel Combustion

This category accounts for about 9 percent of GHG emissions in California, and is estimated to emit approximately 45 MMTs of GHGs in 2020 in the revised baseline forecast. Emissions occur when fuel is combusted in millions of individual homes, business or institutions and when the fuel is conveyed to the source. The fuel of choice is overwhelmingly natural gas. The vast majority of emissions in this sector are attributed to combustion. The No-Project Alternative includes slightly more than 4 MMTs of reductions from increased energy efficiency efforts targeting users of natural gas.

The Proposed Scoping Plan did include a measure to reduce GHG emissions from natural gas transmission and distribution, but not from the combustion of the fuel itself, which was proposed to be addressed in the Cap-and-Trade Regulation. ARB evaluation of this transmission and distribution measure found that the emissions from this category were overestimated in the 2008 Scoping Plan. ARB staff now estimates potential emission reductions of 0.5 MMT, down from a previously estimated 0.9 MMT. However, the cost, cost-effectiveness, and feasibility of a potential regulation have not yet been fully evaluated. Staff is continuing to evaluate this measure due to the potential co-benefits of reducing smog-forming, volatile organic compounds. ARB staff review of this category concluded that there is little additional potential to gain significant reductions from direct regulation of individual sources and, as with many other regulations affecting potentially millions of sources, would be challenging to administer if applied at the end-user level, i.e., the individual home or small- or medium-sized business.

High Global Warming Potential Gases

High GWP Gases are powerful global warming substances that pose unique challenges. Just a few pounds of high GWP gases can have the equivalent effect on global warming as several tons of carbon dioxide. Based on the warming potential and the persistence in the atmosphere, the impact of high GWP gases is normalized to the impact of carbon dioxide, and is represented by "CO_2 equivalents." This sector is estimated to emit approximately 38 MMTs of GHGs in 2020 in the revised baseline forecast.

ARB has adopted several measures to reduce GHG emissions from high GWP gases including standards for semiconductor manufacturing, restrictions on the use of sulfur hexafluoride (SF_6) in both electrical and non-electrical uses, limits on the use of refrigerant recharge canisters for automobiles (typically used by do-it-yourselfers), and a refrigerant management program for systems that use more than 50 pounds of high-GWP refrigerant. ARB is also considering additional measures to address installed high GWP gases in vehicles as part of the Advanced Clean Car regulatory development.

The 2008 Scoping Plan included a measure to reduce GHG emissions from high GWP gases via a fee. ARB staff evaluation indicates that, at this time, a regulation to levy a fee on purchases of high-GWP gases to reduce emissions and incentivize conservation and recovery from high GWP gases is not feasible. To address equity, competitiveness, and nexus issues – that is, to ensure that the fee raised is used directly to address a problem or issue related to the material on which it is levied -- a high-GWP fee would likely need to be levied on over 1,500 fee payers, many of which have not been subject to air quality requirements. The lack of an obvious regulated party for imported high-GWP gases presents a significant concern of leakage (i.e., high-GWP gases that are imported and circumvent the fee). As a result, this measure has significant enforcement issues. ARB staff also evaluated the potential of a regulatory phase-down or phase-out of high GWP gases. ARB believes that, although this option may have potential in the future, such a regulation is also not feasible at this time because there are not, at present, sufficient alternatives to replace high GWP gases.

Agricultural Sources

Agricultural sources of GHG are generally diffuse sources of emissions, such as enteric fermentation from livestock (a product of the digestion of ruminants such as cows), decomposition of manure from livestock, emissions from soil, and energy use in on-farm operations, such as agricultural pumps. No specific direct regulatory activities are proposed for these sources for a variety of reasons, including technical feasibility, animal welfare concerns, lack of technical data, and cost and cost-effectiveness issues.

Post-harvest activities, such as food processing, are generally considered industrial activities and potential emission reduction strategies are discussed in the general residential and commercial combustion portion of the industrial section. This sector is estimated to emit approximately 29 MMTs of GHGs in 2020 in the revised baseline forecast.

A discussion of specific subsectors follows:

Manure Management

The Proposed Scoping Plan identifies manure management through the use of digesters as a voluntary measure. After additional evaluation, ARB continues to believe

that a voluntary approach is the appropriate path for manure digesters. In California, most dairies are located in the San Joaquin Valley, which requires that new emission sources (such as energy generation using methane as the fuel source from dairy digesters) meet strict smog standards. The quality of manure biogas generated in digesters makes it difficult and costly to meet those smog standards. Costs associated with gas clean-up systems, add-on emission controls, and ultra-clean technologies (fuel cells) make it cost prohibitive for many projects to proceed. A voluntary approach, supported by a voluntary offset program, allows the opportunity for technology testing to demonstrate a clean pathway to larger scale deployment of digesters.

Enteric Fermentation

Suggestions to reduce GHG emissions from enteric fermentation from livestock have included changes to feed or containment of livestock in barns with methane control technology. ARB does not believe that a direct regulatory approach is feasible for either of these approaches. In sectors that affect livestock, ARB must be particularly careful that potential regulations do not negatively impact animal health or welfare. For example, wholesale changes to livestock feed to reduce enteric fermentation emissions may jeopardize animal health and welfare. In addition, shifting from low-energy feed to the higher-energy feed that could reduce enteric fermentation may not reduce overall GHG emissions on a lifecycle basis. Requiring barn enclosures to trap enteric methane would rely on un-demonstrated technology to separate methane from barn air. If methane were collected, the issues associated with consuming or combusting the biogas would mirror the challenges currently facing manure digesters. In addition to potential animal welfare issues and cost, enclosed barns would also require cooling in the summer, potentially outweighing the GHG benefits of capturing the methane.

Soil Emissions

The Proposed Scoping Plan described a research program to evaluate nitrous dioxide (N_2O) emissions from soils as a result of fertilizer application. Some limited and localized research in California has found that decreases in fertilizer use may reduce N_2O emissions. However, generalizing those results statewide is difficult and highly uncertain due to differences in crop types, climate, soil type, soil moisture, soil pH, soil microbial activity, and individual farm management practices such as irrigation method, irrigation timing, tilling practices, crop rotation, fertilizer type, fertilizer application method and the timing of fertilizer application. ARB is continuing to fund research into N_2O emissions, and believes that given the number of outstanding questions, regulations are not feasible at this time.

Summary of Alternative 3 Strategy

The Alternative summarized below describes a technically feasible approach that allows as much flexibility as possible while still delivering the needed reductions, i.e., an additional 22 MMTs of GHG in 2020. This is the minimum quantity of emission reductions needed, and assumes that all other adopted and foreseeable measures achieve the estimated emission reductions. The strategy would consist of three major elements affecting automobiles and the largest emissions sources with reduction potential in the electricity or industrial sectors. These measures are summarized below.

The Advanced Clean Car standards included in Alternative 3 are based on the proposal being developed by ARB. This measure would reduce emissions of GHG, as well as criteria pollutants and TACs. The standards would update and link several existing programs that reduce pollution from vehicles into a single regulatory framework. This framework includes the Low-Emission Vehicle program (LEV III), the Zero-Emission Vehicle (ZEV) program and the GHG reduction program (often called Pavley standards). A Clean Fuels Outlet component (principally directed at the deployment of hydrogen fueling stations) would also be considered for inclusion in the alternative. All four elements are critical to reduce the level of criteria pollutants and GHG emissions that new passenger vehicles sold in California will generate through model year 2025. The numbers of plug-in hybrids and zero-emission vehicles in California would be accelerated and supported, as well.

New performance standards in LEV III would provide auto manufacturers a clear target for meeting environmental standards over the next 15 years, and identify a pathway to even lower emissions by mid-century. To achieve this longer term goal, ARB also plans to integrate its ZEV requirements into this new effort. ZEVs include battery electric, fuel cell, and plug hybrid electric vehicles. These vehicles are just beginning to enter the marketplace, and are expected to be fully commercial by the end of this decade. Most vehicle manufacturers agree a portfolio of these technologies would be necessary to meet climate targets by 2050.

Alternative 3 includes a requirement that electric utilities displace at least 50 percent of their coal-based generation with generation that has no higher emissions than the emission rate set by CPUC and CEC for new, long term energy contracts pursuant to SB 1368, Statutes of 2006. In effect, this results in about a 26-percent reduction in emissions. The likely response to such a regulation would be construction of new, and expanded use of existing, combined-cycle natural gas plants. Because of the difficulties in getting new plants constructed and permitted, particularly in California, such construction may take considerable time, and most new and expanded plants would be outside of California. The most likely location for new plants would be where existing natural gas lines and transmission lines are in close proximity. Extension of natural gas and/or transmission lines any considerable distance is a costly undertaking. An important consideration, though, is that the 2020 target leaves only nine years to site, build and permit plants.

To provide the balance of emission reductions needed to achieve the 22 MMT, three industrial categories have been identified. In each of these source categories, a GHG emission cap would be applied that, on average, reduces GHG emissions by 20 percent from the levels projected in the 2020 baseline forecast. The cap would be applied to the following source categories:

- Large refineries
- Cement production facilities
- Large oil and gas extraction facilities

Table 2.5-1 presents the baseline 2020 emissions, the reductions and the remaining emissions if the percentages used above were applied uniformly to each sector.

Table 2.5-1 Summary of Emission Reductions in Alternative 3

Major Emission Category	2020 GHG Emissions (MMT)	Reduction Target	GHG Reductions (MMT – 2020)
Electricity Generation			
Coal Fired	23.4	26%	6.2
Industrial Sector			
Refineries	35.0	20%	7.0
Oil & Gas Extraction	15.8	20%	3.2
Cement Production	9.2	20%	1.8
Advanced Clean Cars	--		3.8
Total			22.0

Source: ARB data, 2010a–f

The combined impact of these measures would produce the 22 $MMTCO_2E$ of reductions needed to replace reductions associated with the Cap-and-Trade and Advanced Clean Car measures. The percentages presented above are not meant to be definitive, but do illustrate the magnitude of the minimum reductions needed to replace a cap-and-trade program. An extensive rulemaking process would be needed to determine the precise percent reductions and actual caps that would be applied to each sector, and then to each facility. This effort would also need to evaluate the best split of reduction burden between sources in the electricity sector and those in the industrial sector. A phase-in of facility caps and phase down of coal generated electricity would begin around 2015 with caps set at close to the expected BAU levels. To maintain as much flexibility as possible, facility caps could be applied on a biennial basis, and early reductions could be banked for later use. This approach could result in high control costs, due either to the need for expensive measures to reduce emissions, or to lost revenue due to curtailment of production to levels allowed by facility caps.

Alternative 3 Impact Discussion

Objectives

Alternative 3 could potentially meet the fundamental objective of reaching the 2020 emissions reduction target; however, the substantial risk of leakage to other unregulated states could undermine the benefits of this achievement and would be inconsistent with AB 32, because it could jeopardize grid reliability and increase consumer cost with reduced cost-effectiveness. This Alternative would seek to reduce GHG emissions by 22 $MMTCO_2E$ through the use of source-specific performance standards for the Advanced Clean Car Program, electricity generation, and the industrial sources of refineries, cement production, and oil and gas extraction. Based on evaluations of current emissions, the availability of feasible reduction measures, and the enforceability

of a direct regulation approach, it is expected that the necessary level of reduction would be achievable from the four source types.

The achievement of other basic objectives of the Scoping Plan would be variable for Alternative 3. For instance, it would reduce fossil fuel use through reduction of operations and create an enforceable program that would ensure in-state emission reductions. The co-benefits of reduced criteria pollutants and TACs would be expected within the facilities of the four sources and where disadvantaged communities are located. However, it is uncertain that Alternative 3 would result in the most cost-effective GHG emissions approach, because performance standards would be set administratively and not based on the market. Most importantly, the effectiveness of the approach would likely be hindered by substantial leakage, which would not be consistent with the Scoping Plan objectives and may not ultimately meet the environmental objectives or other substantive requirements of AB 32.

Environmental Impacts

This Alternative focuses on source-specific emission limitations by regulation to reduce GHG emissions sufficiently to achieve a 22 $MMTCO_2E$ reduction by 2020. Specifically, the strategy for this Alternative would affect automobiles and the electricity generation and industrial sectors (i.e., refineries, cement production, and oil and gas extraction), which are the largest emission sources with reduction potential. As shown in Table 2.5-1, the strategy would consist of: requirements for various types of advanced clean cars; for electric utilities to displace at least 50 percent of their coal-based generation with lower-carbon fuel-based generation; and for application of a cap to large refineries, cement production facilities, and large oil and gas extraction facilities, which on average would reduce GHG emissions by 20 percent.

This approach would afford each facility the flexibility to meet emission obligations. Compliance responses for electricity and industrial sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. The likely response to the coal-displacement regulation would be construction of new, and expansion of existing, combined-cycle natural gas plants. Because of the difficulties in getting new plants constructed and permitted, particularly in California, such construction may take considerable time and most new and expanded plants would be outside of California. Compliance responses to the Advanced Clean Car Program would involve improved engine and transmission technologies, vehicle technologies, mass reduction, electrification and accessory technologies, and electric drive technologies including hybrid technologies. The improvements in vehicle technology would result in greater use of electricity and fuel cells for powering vehicles and construction of alternative fueling stations to serve plug-in hybrid, battery electric vehicles, and fuel-cell vehicles.

Aesthetic impacts resulting from Alternative 3 would be less than significant, because compliance responses are focused on small fueling facilities for Advanced Clean Car and modification of existing industrial facilities and uses. Under this alternative, in-state compliance responses for the industrial sources could include curtailing production,

implementing energy efficiency modifications, making fuel changes, and other operational improvements. Implementation of this Alternative would not be anticipated to result in adverse aesthetic impacts because any construction- or operational-related activities would likely occur within existing industrial facilities, where the aesthetic character is already established and would not be substantially changed. An exception may be if new combined-cycle natural gas power plants are constructed (likely outside California), which would be of sufficient size to potentially cause significant adverse aesthetic impacts. Fueling stations for advanced clean cars would be expected where existing fuel stations are located or where local zoning allows such a use. Leakage issues for industrial sources could result in both construction and operational impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, aesthetic impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant, with the exception of potential new combined-cycle, natural gas power plants built in response to a regulation to reduce coal-fired electricity generation.

Agricultural and forest impacts resulting from Alternative 3 would be less than significant, because compliance responses are focused on modification of existing industrial facilities and uses. Under this alternative, in-state compliance responses for industrial sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. Small Advanced Clean Car fueling stations would be near highways and in communities, rather than in important agricultural or forest resource areas. If a new fueling station is built next to a highway interchange, it may occupy the edge of some agricultural or forest area, but the encroachment would be minimal and would not be expected to substantially affect the overall resource. If new combined-cycle, natural gas power plants are built in response to a regulation to reduce coal-fired electricity generation, they would likely be located near existing transmission lines (probably outside California). While it is conceivable that a new electricity generation facility could affect agricultural or forest land, facilities would be expected to locate at or near existing electricity generation and transmission infrastructure, where adverse impacts to agricultural land and forests could be avoided. Implementation of this Alternative would not be anticipated to result in adverse agricultural or forest impacts because any construction- or operational-related activities would likely occur within existing industrial areas or where important agricultural or forest resources would not be located. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas (for industrial sources), within existing communities (for Advanced Clean Car fueling stations), or near existing electricity generation and transmission infrastructure (for repowered or new electricity generation facilities to displace coal-fired generation). Consequently, agricultural and forest impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant.

Air quality impacts of Alternative 3, in general, would be regionally beneficial within the state because measures that reduce GHG emissions also provide co-benefits in terms

of reductions in regional criteria air pollutant and TAC emissions because of their similarities in source types. Thus, implementation of this Alternative would reduce statewide levels of criteria air pollutants and TACs resulting in a beneficial effect. However, implementation of this Alternative could result in substantial leakage for industrial sources and electricity generation, because the performance standards placed on the covered sectors are not defined by market conditions. For example, replacing high carbon fuels (e.g., coal) with lower carbon fuels (e.g., natural gas) could result in out-of-state electricity now being used by California being sold in other markets. Additional natural gas power plants could be built outside the state to meet the performance standard (if generators are seeking to avoid the regulatory restrictions in California), which could shift the location of pollutant emissions. Also, if the performance standard limit applied to refineries, cement production, and oil and gas extraction were set too stringently, such facilities could decide it is more cost-effective to curtail in-state output and shift operations out-of-state, rather than invest in energy efficiency or other modifications in California. If this occurred, it would reduce in-state GHG and co-pollutant emissions, but also increase out-of-state production and importation/transportation potentially resulting in increased out-of-state and transportation emissions. Consequently, implementation of this Alternative could result in adverse regional and local air quality impacts out-of-state associated with construction (e.g., use of heavy-duty equipment) and operational (e.g., higher facility production levels) increases in criteria air pollutants and TACs. Best management practices exist to reduce these potentially significant impacts. However, the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects and out-of-state environmental regulations are often not as protective as California's regulatory framework. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Also, the specific locations and impact of any such emission increases are uncertain. Thus, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that these air quality impacts would be potentially significant and unavoidable.

Adverse biological impacts resulting from Alternative 3 could occur, if compliance responses require modification of existing industrial facilities, construction of new fueling stations for Advanced Clean Cars, or development of new lower-carbon fuel electricity generation facilities where biological resources are present. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect natural habitats and sensitive species, if they are present around existing facilities or at construction sites for new facilities. Construction, grading and trenching have the potential to adversely affect any protected biological resources that might exist at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine

project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant biology impact may be unavoidable.

Adverse cultural resources impacts resulting from Alternative 3 could occur, if compliance responses require modification of existing industrial facilities, construction of new fueling stations for Advanced Clean Cars, or development of new lower-carbon fuel electricity generation facilities where archaeological or historic resources are present. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could disturb cultural resources, if they are present around existing facilities or at construction sites for new facilities. Construction, grading and trenching have the potential to adversely affect any potentially important cultural resources that might exist at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant cultural resources impact may be unavoidable.

Energy-related effects of Alternative 3 would be beneficial, because the GHG reduction strategy of direct, source-specific performance standards also results in improved energy efficiency and reductions in fossil fuel use. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. For Advanced Clean Cars, the use of batteries and other Alternative fuels would conserve fossil fuels. These actions would reduce overall energy demand in-state, particularly related to curtailed operations, and are considered beneficial effects. However, implementation of this Alternative could result in increased energy demand out-of-state associated with leakage (e.g., shifting production out-of-state resulting in greater operational emissions), because siting, permitting, and construction of new power plants in California may be difficult to accomplish within the time frame. The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects in other states. Consequently, while the net change would still be beneficial (i.e., less total energy demand), the potential level of benefit would be diminished because of the potential for substantial leakage.

Adverse geology, soils, and mineral resources impacts resulting from Alternative 3 could occur, if compliance responses require modification of existing industrial facilities, construction of new fueling stations for Advanced Clean Cars, or development of new lower-carbon fuel electricity generation facilities where new ground disturbance and landscape alteration are needed. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect local geology and soils. Construction, grading and trenching have the potential to cause soil erosion, dust generation, and sedimentation of local waterways at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant geology and soils impact may be unavoidable.

GHG emissions would be expected to decrease in California with the imposition of source specific regulations. This Alternative focuses on a performance-standard limitation by regulation on key emission sources to decrease GHG emissions sufficiently to achieve a 22 $MMTCO_2E$ reduction by 2020. As described above, the strategy would consist of requiring and promoting Advanced Clean Car technologies, requiring electric utilities to displace at least 50 percent of their coal-based generation with lower-carbon fuel-based generation, and applying a cap to large refineries, cement production facilities, and large oil and gas extraction facilities. Thus, GHG-related impacts of this Alternative would be beneficial because of the fundamental objective of this program to reduce in-state GHGs. However, implementation of this Alternative could result in adverse GHG impacts out-of-state associated with increases in GHGs from leakage (e.g., shifting production out-of-state resulting in greater operational emissions). The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects in other states. Consequently, while the net change would still be beneficial (i.e., less GHG emission than current conditions), the level of emissions would likely not achieve the 2020 target because of the potential for substantial leakage.

Hazard and hazardous materials-related environmental impacts of Alternative 3 would be less than significant. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and implementing other operational improvements. The use of hazardous materials is common practice in industrial settings. Implementation of compliance responses could include the use of hazardous materials, but this would be considered simply a continuation of existing

business practices for the covered entities, controlled by existing practices and regulations, and, thus, considered less than significant. All projects would be required to comply with established local, state, and federal laws pertaining to the use, storage, and transportation of these materials. The greater use of vehicle batteries and fuel cells would increase their production, storage, recycling, and ultimately disposal. An increase of batteries and fuel cells in the waste stream could result in potential hazardous materials and water quality effects; however, regulations exist for handling of hazardous materials and protection of water quality from waste disposal facilities and ARB is also considering specific regulatory requirements for further protection in the Advanced Clean Car Program design. Assuming compliance with applicable laws and regulations, the impacts would be less than significant.

Adverse hydrology and water quality impacts resulting from Alternative 3 could occur, if compliance responses require modification of existing industrial facilities, construction of new fueling stations for Advanced Clean Cars, or development of new lower-carbon fuel electricity generation facilities near local water features. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect local drainage and discharge of contaminants to local waterways. Construction, grading and trenching have the potential to cause soil erosion and sedimentation of local surface water resources at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant hydrology and water quality impact may be unavoidable.

Land use impacts of the compliance responses of Alternative 3 would be less than significant, because they would not change the fundamental use of facility sites and new facilities would be located where local planning and zoning allow them. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements and, as such, would be consistent with the existing land use and would pose a less than significant land use and planning impact. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas or at or near existing electricity generation and transmission infrastructure. Consequently, land use impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant.

Adverse noise impacts could result from Alternative 3, because of the potential for substantial leakage of operations in covered sectors to other states. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. Implementation of this Alternative would not be anticipated to result in adverse noise impacts at the facilities of existing in-state sources, because no major noise-generating construction- or operational-related activities would likely occur. If such were to transpire associated with onsite modification or improvements, they would be minor, intermittent and temporary in nature, and similar (or less) to the levels from sources that currently exist within these industrial settings. Construction of Advanced Clean Car fueling stations may result in temporary, construction noise within existing communities; however, local noise ordinances would be expected to maintain impacts at less-than-significant levels. Thus, these impacts would be considered less than significant. However, leakage issues could result in both construction and operational impacts out-of-state because of the generation of noise levels that exceed ambient conditions at existing sensitive receptors. For example, an out-of-state cement facility could expand current operations to increase production resulting in increased on-site noise levels from construction and operation, and offsite noise levels from increased truck travel associated with material transport. Best management practices currently exist (e.g., limiting construction activities to the less noise-sensitive daytime hours and obstructing the line of sight between sources and receptors for operational activities) to reduce these potentially significant noise impacts. However, the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Also, the specific locations and impact of any such noise increases are uncertain. Thus, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that these noise impacts would be potentially significant and unavoidable.

Adverse population, employment, and housing effects would not occur from the source-specific regulations in Alternative 3, including from the operational and facility-modification compliance response projects, because the compliance activities would not substantially change socioeconomic conditions. All impacts to population, employment, and housing would be less than significant.

Public services impacts of Alternative 3 would be less than significant, because direct regulation compliance response activities would occur at existing facility sites where public services are already provided. Under this alternative, in-state compliance responses for industrial or electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. All potential impacts to public services would be less than significant. These projects would not substantially increase the level of public services beyond that already provided to existing facilities. Leakage issues could result in both

construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas or at or near existing electricity generation and transmission infrastructure. Consequently, public services impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant.

Recreation impacts of Alternative 3 would be less than significant, because direct regulation compliance response activities would occur at existing facility sites or within communities at locations allowed by local zoning codes. The source-specific regulations, including the expected compliance responses, would not result in increased demand for or adverse impacts to recreation resources. The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities in the state. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, recreation impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant.

Adverse transportation impacts could result from Alternative 3, because of the potential for substantial leakage of operations in covered sectors to other states and the resulting need for additional transportation of affected products. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and implementing other operational improvements. Implementation of this Alternative would not be anticipated to result in adverse transportation or traffic impacts, because no major traffic-generating construction or operational activities would likely occur. If such were to occur, any construction traffic increases would be temporary and mitigated through ingress and egress controls, traffic controls, and reduced speed zones to ensure safety, and operational traffic levels would be similar to existing conditions. Thus, these impacts would be considered less than significant. However, leakage issues could result in both construction and operational impacts out-of-state because of the generation of traffic. For example, an out-of-state cement facility could expand current operations to increase production resulting in increased traffic on the local roadway network from additional employees and material transport. Also, new combined-cycle, natural gas power plants may be built in response to the requirement to displace coal-fueled electricity generation, resulting in substantial construction traffic. Increased interstate transport of products into California could also be required. Best management practices exist to reduce these potentially significant impacts. However, the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. In addition, project-specific mitigation details are not available at the programmatic stage of analysis, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Thus, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and

discloses, for CEQA compliance purposes, that these transportation impacts would be potentially significant and unavoidable.

Utility and service system impacts of Alternative 3 would be less than significant, because these activities would occur at existing facility sites where utility systems are already provided. Under this alternative, in-state compliance responses for industrial and electricity sources could include curtailing production, implementing energy efficiency modifications, making fuel changes, and other operational improvements. These projects would not increase the level of utilities beyond that already provided to existing facilities. The availability and extension of utilities is subject to approval of the local utility provider, and readily implemented in a manner that would be less than significant. Leakage issues could result in both construction and operational impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas or at or near electricity generation and transmission infrastructure. Consequently, utility and service system impacts resulting from compliance responses to source-specific performance standard regulations would be less than significant.

2.6 Alternative 4: Adopt a Program Based on a Carbon Fee or Tax

Goal of Alternative 4

The goal of Alternative 4 is to evaluate a reasonable approach to GHG emissions reduction relying on a carbon fee or tax program to achieve the remaining reductions (i.e., approximately 22 $MMTCO_2E$) needed to make up for the amounts intended to come from Cap-and-Trade and an Advanced Clean Car Program to meet the 2020 GHG reduction target. It is intended to help decision-makers consider whether a strategy based on carbon pricing assigned by ARB to regulated sources, instead of relying on an emissions cap would reduce or otherwise substantially change potential effects on the environment.

Role of Alternative 4 in the Range of Alternatives

Within the range of alternatives, a carbon fee represents an approach where pricing is set by the state. The carbon fee or tax is an example of a charge levied on an economic activity that causes a negative cost (i.e., costs incurred by the public and the state resulting from global warming risks, in this case) that would otherwise not be taken into account in the market price of the activity; these costs are sometimes called “externalities.” The primary purpose of a carbon fee is to reflect the externalities in the market price, thereby raising the cost of processes and products that generate the emissions and providing incentives to switch to lower emitting activity. The carbon fee or tax provides a clear signal of the price that parties will face for their GHG emissions. Setting the cost of carbon emissions on covered entities through a fee or tax does not guarantee a specific emissions outcome because there is neither a regulated cap (as in Cap-and-Trade) nor a defined performance standard (as in a direct, source-specific regulation). Defined administratively by statute and/or regulation, the carbon fee or tax

would not typically adjust with changing market conditions (unless special provisions were included in legislation or regulations for automatic adjustments).

Precedents or Examples of the Approach in Alternative 4

A carbon fee or tax is a charge levied on the carbon content of a fuel or the equivalent emissions produced when the fuel is used. Many carbon fees (or taxes) have been enacted at national and state/province levels around the world, as summarized in Table 2.6-1. There is fairly wide variation in the rates imposed and the sources of carbon covered. In some jurisdictions, such as in Europe, the carbon fee is complementary to a comprehensive cap-and-trade program (EU-ETS). In other cases, such as Boulder, Colorado, the fee is a (perhaps temporary) substitute for a broader comprehensive program. In Canada, provincial taxes in Quebec, Alberta, and British Columbia provide a means to help achieve the emission reductions that Canada has agreed to under the UN Framework Convention on Climate Change's Kyoto Protocol, in light of the fact that Canada's federal government has not implemented a cap on emissions at the national level. Several countries other than those in Table 2.6-3 are either now considering a carbon fee or tax (United Kingdom, South Korea, Taiwan, South Africa) or recently deliberated on and decided against one (France, Slovenia, Japan, and New Zealand). Australia recently announced plans to implement a carbon tax in 2012 as a transitional strategy to a cap-and-trade program (Daley 2011).

The examples above suggest that carbon fees and taxes have been taken seriously by a number of other jurisdictions as a means to address GHG emissions. Several Scandinavian countries experimented with carbon-related taxes in the early 1990s, but they were often assigned to parts of the energy mix, not comprehensively, and have changed over time as climate and energy policy has evolved. The Kyoto Protocol agreement is structured around national caps, but individual countries can implement their own national strategies, including a fee or tax, if they choose. The existence of carbon fees or taxes in some European countries – which have also adopted national caps on emissions -- suggests that some governments there feel the need to supplement the cap-and-trade program, especially recognizing that not all sectors are covered by the EU-ETS.

Because many countries have just recently implemented a tax and the tax is often mixed with other strategies, it is not yet feasible to assess the program's success nor to segregate the success of the tax component from the overall program. For example, British Columbia uses a revenue-neutral approach to reduce personal and corporate income taxes. In terms of revenue, the carbon tax between 2008 and 2009 collected $846 million and reportedly resulted in $230 million net reductions to taxpayers there. Modeling anticipates that the British Columbia system will reduce emissions by five percent (Plumer 2010).

Table 2.6-1 Current Examples of Carbon Fees or Taxes

Location	Fee or Tax Rate	Comments
Denmark	$17.47 (90 DKK/MT)	As of 2008[1,2]
Norway	$5-70 (25-380 NOK/MT)	As of 2011. Varies by emission level; some can be covered with emissions trading scheme.
Sweden	$164.18 (€103/MT) for households and services $31.88 (€22/MT) for sectors subjected to leakage and outside EU ETS $21.73 (€15/MT) CO_2 for sectors subjected to leakage and inside EU ETS	As of 2010[3]. Much higher prices for general level compared to industry level. Various exemptions[4].
Finland	$43.47 - 72.45 (€30 -50/MT)	As of 2010; only traffic and heating fuels[5]
Switzerland	$40.43 (36 Swiss franc/MT)	As of 2010. Companies participating in cap-and-trade can be exempt.[6]
France		Plan for $24.62/MT (€17/MT) tax abandoned[7].
Ireland	$21.72 (€15/MT)	As of 2010. Relief for electricity generation, chemical reduction, and electrolytic/metallurgical processes.[8]
Quebec, Canada	$3.11 (C$3/MT)	As of 2009[9, 10]
British Columbia, Canada	$20.79 (C$20/MT)	As of 2011; will rise to $31.19/MT (C$30/MT) July 2012[11, 12].
Alberta, Canada	$15.60 (C$15/MT)	As of 2008[13]
Costa Rica	3.5% on fossil fuels market price	Steady percent rate since 1997[14, 15]
India	$3.19 (50 rupees/MT of coal (1 short ton of coal = 2.86 short ton of CO_2[16]))	As of 2010, only for coal, both produced and imported to India.

Table 2.6-1 Current Examples of Carbon Fees or Taxes

Location	Fee or Tax Rate	Comments
California, USA	4.8 cents/MT	As of 2008, applies only to Bay Area Air Quality Management District[17].
Colorado, USA	$7.71/MT	As of 2008, on electricity consumption in the City of Boulder, CO[18] and expires by March 2013[19].
Maryland, USA	$5 .51/MT	As of 2010, from any stationary source in Montgomery County, MD[20]

MT = metric ton

[1] http://www.ees.uni.opole.pl/content/03_10/ees_10_3_fulltext_01.pdf
[2] http://www.nrel.gov/docs/fy10osti/47312.pdf
[3] http://www.norway.or.jp/Global/SiteFolders/webtok/PDF/20_Years_of_CO2_Taxation_in_Sweden.pdf
[4] http://www.iea.org/textbase/nppdf/free/2008/Sweden2008.pdf
[5] http://www.environment.fi/default.asp?contentid=147208&lan=en
[6] http://www.bafu.admin.ch/co2-abgabe/05179/05314/index.html?lang=de
[7] http://www.telegraph.co.uk/finance/newsbysector/energy/7507015/France-ditches-carbon-tax-as-social-protests-mount.html
[8] http://www.taxireland.ie/TaxFind/ContentHTML/ParsedHTML/AITIManuals_HTMLFILES%5CITM_HTMLFILES%5Cc33.t2.st3.html
[9] http://www.cdhowe.org/pdf/backgrounder%20118_English.pdf
[10] http://www.torys.com/Publications/Documents/Publication%20PDFs/CCB2007-6.pdf
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[12] http://www.sbr.gov.bc.ca/documents_library/notices/British_Columbia_Carbon_Tax.pdf
[13] http://www.cbc.ca/news/business/story/2008/01/08/renner-carbon.html
[14] http://www.policyarchive.org/handle/10207/bitstreams/20176.pdf
[15] http://www.nytimes.com/2009/04/12/opinion/12friedman.html
[16] http://www.indiaenvironmentportal.org.in/files/India%20Taking%20on%20Climate%20Change.pdf
[17] http://articles.sfgate.com/2008-05-22/news/17155215_1_carbon-dioxide-greenhouse-gas-emissions
[18] http://nexus.umn.edu/Courses/Cases/CE5212/F2008/CS7/CS7PPT.pdf
[19] http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844
[20] http://solveclimate.com/news/20100525/maryland-county-carbon-tax-law-could-set-example-rest-country

The Table is generally taken from the following source: Murray, Mazurek, and Profeta 2011.

Attributes of Alternative 4

Key Carbon Fee or Tax Alternative Design Decisions

If a carbon fee or tax was implemented in California, four key design issues must be addressed, as outlined below. (The terms, "fee" and "tax," are generally used interchangeably in the section that follows, because they both levy a price on carbon emissions, with the exception of the discussion of the administrative differences between implementation of a fee or a tax in California.)

Covered Sectors

The covered sectors must be identified. In California, the sectors potentially subject to the carbon fee or tax would be those that were slated to be covered under the proposed Cap-and-Trade Regulation (ARB 2010a). These would include electricity, transportation fuels, natural gas and large industrial sources of 25,000 metric tons or more.

Fee or Tax Level

The level of the fee or tax would need to be decided. The state must determine the carbon fee or tax level and whether and how to change it over time. Table 2.6-2 lists several criteria used by other jurisdictions for setting the carbon fee or tax level. A wide range of fees or taxes can result from consideration of the various criteria. The federal Interagency Work Group on the Social Cost of Carbon conducted a comprehensive exercise to estimate the social cost of carbon, which is one of the potential criteria. Mean values for 2010 ranged from about $5 to $35 per ton CO_2, depending on time discount rates (varying between 2.5 and 5 percent). The value that includes 95 percent of the range of fees or taxes, using a 4 percent discount rate, would be about $65 per ton (IWGSCC 2010).

Table 2.6-2 Representative Criteria for Setting the Carbon Fee or Tax Level

Criterion	Description	Advantages	Disadvantages
Social cost of carbon (SCC)	Economic value of the damages caused by an additional ton of CO_2 equivalent	Consistent with the underlying Pigovian concept that the fee or tax causes the product to reflect its true cost to society	Wide range of estimates depending on studies of varying methodologies and scope
"Pain threshold"	Level above which the economic costs of the fee or tax are deemed too burdensome for affected parties	Pragmatic, recognizing need to reduce shocks especially in early years. Can be combined with strategy to start fee low and phase-in increases over time.	Difficult to determine which single level meets this criterion. Easy to manipulate politically.

Table 2.6-2 Representative Criteria for Setting the Carbon Fee or Tax Level

Criterion	Description	Advantages	Disadvantages
Technology goal	Set at level sufficient to stimulate investment in key technologies deemed critical to achieving long-term reductions (e.g., renewable power, electric vehicles)	Clear rationale to avoid weak or stranded investment. May be easier to estimate initially than alternatives above.	Involves government picking "winner" technologies and may be difficult to match dynamics of technology and cost changes over time.
Comparable prices elsewhere	Set within range of carbon fees, taxes, or prices found in other systems (fee-based or cap-and-trade)	Easy to determine.	Other systems will reflect particular scope and criteria that may be at variance with values and objectives of California program
Environmental objective	Effectiveness in reducing emissions	Stable carbon price over the long term also means consistent, ongoing incentive to reduce emissions.	Indirect influence on emission level with absence of cap. Risk of leakage, if fee or tax does not reflect market price well.

Emissions Basis

The next decision is the exact quantity of emissions subject to the fee or tax. A standard approach would be for all emissions in the covered sector to be subject to the fee or tax. An Alternative would be to assess a *marginal fee or tax* only on emissions above a set level . To compare these approaches, consider a plant planning to generate one million tons of CO_2 emissions in a given year. If the carbon fee or tax is set at $15 per ton, under the full-fee system, the plant would pay $15 million in fees or taxes for the year. If the fee or tax is assigned on all emissions in excess of 900,000 tons, the plant would pay $1.5 million in fees or taxes for the year. In both cases, the firm's monetary incentive to reduce emissions from 1 million to 900,000 tons is the same (save $1.5 million) but the total amount the government receives in revenue would be quite different. Importantly, however, there would be no incentive to reduce emissions below 900,000 tons under the marginal fee or tax approach but there would be a continued incentive to do so under the total fee or tax approach since all tons incur a cost.

If a marginal fee or tax were selected, the state would need to determine the threshold (baseline) level for each covered entity, below which no fee or tax would be assessed. This could be determined based on a range of factors, such as a fixed percentage of historic emissions, a sectoral threshold standard or benchmark (e.g., emissions per unit output), or customized for each individual plant's condition. The marginal fee or tax approach would minimize cost impacts to businesses and discourage leakage, so it is assumed for purposes of the alternatives analysis in the FED Supplement.

Point of Regulation

The point of regulation for the fee or tax is the next critical question. The appropriate point of regulation varies based on the sector. A carbon fee or tax could target the same points of regulation or any point within the state from fuel extraction to combustion to end use. This is often referred to as the point of regulation or point of fee assignment. Options for the point of regulation and their relative advantages are included in Table 2.6-3.

Cost-effectiveness would vary depending on the point of regulation, primarily related to administrative costs. The direct cost of a fee or tax to emitters would not change whether the point of regulation is set upstream, midstream, or downstream. As long as it coincides with the carbon (CO_2, GHG) contained or emitted and can be passed through, the amount charged would be the same no matter where the fee or tax is levied. However, the most substantial cost variations that arise with different points of regulation likely are administrative in nature. The monitoring and transaction costs associated with a fee or tax would generally be smaller on a per ton basis, if imposed at a point where there are relatively few entities responsible for relatively much carbon in an easy-to-monitor form. As suggested in Table 2.6-3, this is typically more likely with upstream regulation. For example, imposing a fee or tax on transportation carbon may be more easily (less costly) accomplished at the refinery or fuel supplier level, with relatively few suppliers transacting in fuel, rather than on emissions at the tailpipe level assessed downstream on millions of drivers. Midstream may involve assessment at thousands of gas pumps across the state. Therefore, in principle, there may be a reduction in administrative and monitoring costs, if assessed upstream. As suggested in Table 2.6-3, the most administratively advantageous point varies. For example, imposing a fee or tax on transportation carbon may be more easily (less costly) accomplished at the refinery or fuel supplier level, with relatively few suppliers transacting in fuel, rather than on emissions at the tailpipe level assessed downstream on millions of drivers. Implementing the fee or tax further downstream may involve assessment at thousands of gas pumps across the state. Therefore, in principle, there may be a reduction in administrative and monitoring costs, if assessed midstream.

Table 2.6-3 Potential Points of Regulation for Fee or Tax Assignment

Fee or Tax Assignment Point	Point of Regulation	Example	Advantages and Disadvantages
Upstream	On fuel content	Assign fee or tax on carbon content of all natural gas, coal, transportation fuels used in California	Relatively easy to administer, as number of fuel producers is small relative to number of users Difficult for "imported" emissions such as electric power generated in another state and transmitted to California Not easily imposed on non-fossil fuel sources (e.g., methane emissions from landfills)
Downstream	Assign fee or tax to final consumer of goods that are responsible for emission	Imposed at gas pump or in electric power bill, for all Californians, based on, consumption of the carbon-emitting product.	May have greater impact on use/efficiency if directly levied on final consumer. With upstream or midstream, cost may ultimately fall on final user anyway through market price adjustments. May have higher transaction costs if levied on millions of consumers directly
Midstream	At point of large stationary sources of combustion	Charged to power plants and factories based on actual GHG emissions there	Lower transaction costs since imposed on few, relatively large emitters. Direct incentives for emission reduction activities, emission leaks.

Source: Murray, Mazurek, and Profeta 2011.

It is important to note that a downstream system may have some indirect cost savings advantages, in terms of spurring efficiency improvements. The potential for savings turns on the assumption that those who most directly bear the price impact have a comparably large incentive to save energy and the attendant emissions reductions that efficiency improvements will bring. Under a system that imposes the fee or tax further upstream, such pricing effects may not be as apparent to the downstream energy user (Niemeier et al 2008) because the charge is imbedded in the cost of the input, rather than directly assessed based on the activity of the downstream party. ARB's economic modeling of the Cap-and-Trade Regulation showed that savings from efficiency improvements significantly lowered the total compliance costs of the Cap-and-Trade Program.

One other possible advantage of downstream assessment is that it may be easier to target relief for low-income households if that is the point of regulation. Certain households could be exempted from the fee or tax. This would be more difficult, if the fee or tax is assessed further upstream and flows down to all households, although it could be addressed by uses of the revenue.

Despite the potential advantages of downstream regulation, from an implementation perspective, a more upstream point of regulation would be the most administratively cost effective approach. The points of regulation assumed in Alternative 4 are as follows. For purposes of this analysis, the point of regulation of electrical generation and industrial sources would be the facility operator (i.e., the generation or industrial facility). For electricity imports, the point of regulation would be the importer. For natural gas, the point of regulation would be the user or distributor of the gas. For transportation fuels, the point of regulation would be the first holder or supplier of refined gasoline or distillate fuel oil.

Administrative Features of a Potential Carbon Fee or Tax

The discussion above addresses four factors to consider in designing a carbon fee or tax program. The administrative steps to creating a fee or tax include: sectoral coverage, fee or tax level, emissions basis, and point of regulation (fee or tax assignment). In theory, a carbon fee or tax may be more straightforward to design and to administer, compared to the other regulatory alternatives. However, in practice, a levy of this nature may be more challenging to design and administer in California owing to legal distinctions between what constitutes a tax and a fee. The following discussion examines what administrative issues California would need to face in practice.

Data Collection and Monitoring

Once the decisions are made about the sectors to be covered, the level of the fee or tax, the emissions basis and the point of regulation, the next step would be to develop data to track the GHG emissions on which the fee or tax is assessed. The amount of data collection and analysis required depends on the point of regulation. An upstream system requires only data on carbon content in fuels and data on fuel quantities. A midstream fuels-based system requires data on carbon content in fuels and data on fuel quantities. A system designed to mimic sources targeted under the proposed Cap-and-Trade Regulation would require emissions data at the regulated source or emissions estimates in the production and use of the final product.

How the environmental effectiveness of a fee or tax would be monitored also depends, in part, on the point of regulation. Fuel use data would be necessary to monitor a fuel based system, whereas emissions estimates or product use would be necessary to monitor the environmental effectiveness of an emission based system.

Collection and Enforcement

In theory, a key administrative advantage to taxes is that they may be levied and enforced through established tax collection methods, rather than developed from the ground up through agencies charged with environmental regulation, which could be the case for a fee. For example, a federal carbon tax, similar to a fuel excise tax, could be levied and collected by the U.S. Department of the Treasury instead of the U. S. EPA. Under a fuel based system, fuel suppliers would account and pay in a manner much like other taxes to which they are accustomed. California corollary to administer Treasury's functions would be the State Board of Equalization or Franchise Tax Board. In British Columbia, a Western Climate Initiative partner to California, retail gasoline establishments collect the carbon tax and remit revenues along with other monies to the provincial revenue collection authority. Because the tax may be based on transaction records (e.g., fuel purchase) and not measurement of emissions, non-compliance could be achieved through financial cheating or evasion. Accordingly, enforcement against a transaction based tax would take place in large part through established tax auditing systems.

Revenue Uses

Depending on the emissions basis (e.g., marginal emissions or total emissions), a fee or tax holds the potential to generate a greater or lesser amount of revenue per year. As in the case of an allowance auction, a state with a carbon fee or tax must then decide how to use those revenues. ARB's Economic and Allocation Advisory Committee (EAAC 2010, p. 33-34) identified four potential uses of allowance revenues including reducing the disproportionate impact of higher fuel prices caused by a fee or tax on low income households; financing government expenditures; reducing income or sales taxes; or providing public dividends in such forms as direct payment or a trust fund for education. The Alaska Permanent Fund, which recycles oil-extraction royalties to Alaskans, is one example of a dividend model. Varying degrees of flexibility in revenue use apply in California, based on the different legal restrictions of fees versus taxes, as discussed below.

Avoiding Leakage

Because a fee or tax, like a cap-and-trade approach, would place a price on carbon emissions by in-state industrial sources, both systems are prone to leakage of economic activity and attendant emissions to jurisdictions without carbon regulation and pricing. Here, "leakage" refers to the incentive for regulated entities with high GHG emissions or energy costs to shift or to relocate activity to states without carbon regulation, fees, or taxes to avoid the added cost, which then could erase the emission reductions achieved in-state. A cap-and-trade program addresses leakage through the use of free allocation of allowances to trade-exposed, energy-intensive industries. For this alternative, implementation could result in leakage if not accounted for in the design of the alternative. For a fee or tax, administrative mechanisms may be necessary to address leakage, such as something called a border adjustment (which are import fees levied by a carbon-taxing jurisdiction on goods coming in from non-carbon-taxing jurisdiction to eliminate the cost avoidance advantage of relocation) or other mechanisms such as the use of rebates. For purposes of this analysis, the design of

this Alternative is assumed to include appropriate mechanisms that minimize the potential for leakage.

Administrative Issues Specific to California

"Fee" and "tax" have been used interchangeably in this discussion so far, because they both have the effect of pricing carbon and in some jurisdictions the terms are interchangeable in operation. In California, a fee and a tax have distinct legal characteristics, which bring different legal requirements and restrictions to bear. As a result, in practice a carbon tax could operate differently from a carbon fee in California. Both are discussed below.

Under California's Constitution, as of 2006 – when AB 32 was enacted into law – a tax requires a legislative supermajority (two-thirds) vote, whereas a fee traditionally only requires a simple majority vote of the Legislature. For purposes of this analysis, ARB would adopt the carbon fee regulation under the authority of AB 32. If new legislation were required for ARB to adopt a carbon fee, the requirements of Proposition 26 (approved in 2010) – which expanded the definition of a "tax" – would determine whether a legislative majority or supermajority vote is required.

In general, with a tax, there are no restrictions on the level of the tax or how the money is appropriated for use. The tax levy and appropriation for use are defined by the Legislature. For example, the revenue from a tax may go into the state's "general fund," from which a wide variety of public services and programs are funded. By contrast, with a fee, the amount collected and the uses for which the money may be appropriated are subject to limitations based on a complex legal test. The purpose of this alternatives analysis is not to provide a legal opinion, but rather to discuss the limitations on fees in laypersons' terms.

Generally speaking, the total amount collected via the fee must not exceed the reasonable cost of the government program, and the fee must be allocated reasonably among fee payers based on their responsibility for causing the burden that made the program necessary or the benefits they directly or indirectly receive from the program. Thus, subject to those restrictions, at the time AB 32 was enacted, the Legislature could, by a simple majority vote, authorize agencies to establish fees to pay for environmental damages and the costs to administer programs to address those damages. The revenues from a carbon tax could, however, be used to offset lower income or sales taxes or to create a trust fund for public education, or other legislatively authorized purposes; such use of revenue would not be available under a fee.

With these distinctions between a tax and a fee in California in mind, whether and how such programs might operate and who would operate them could look very different in practice. To implement a carbon tax in California, the Legislature would need to approve the tax by two-thirds supermajority. Such a scenario is extremely unlikely for the foreseeable future. Alternatively, a carbon tax could be placed on the ballot with sufficient signatures, but this scenario would require significant outside resources to

pass such a measure. The challenges surrounding approval of a carbon tax could make this approach infeasible as a practical matter.

Assuming hypothetically that such a tax would pass by legislative vote or by popular vote, the administrative steps to implementation would be consistent with those outlined above. Legislators or voters could set the tax and decide whether to return revenues to the general fund, return revenues to taxpayers, or use the value for other goals as outlined by the EAAC (2010). Under this statutory authority, ARB could establish the point of regulation, based on carbon content or emissions data. ARB could administer the program and monitor progress towards emissions reductions. However, an existing taxing agency, such as the State Board of Equalization or Franchise Tax Board, theoretically could levy, collect, and monitor the tax, as well as administer personal tax reductions, if the state were to implement such an approach. Because the primary goal of this tax would be to achieve targeted reductions in GHG emissions, it would be necessary to return to the Legislature or to voters to raise additional taxes, for example if monitoring shows that the program is failing to achieve GHG emission reduction targets (although the initial tax authorization could include an automatic adjustment).

In contrast to a tax, additional legal and administrative considerations would need to be brought to bear under a California carbon fee program. Here, the legal requirements for a fee would make such decisions as on what basis to levy a fee and where to apply to the point of regulation more complicated. As discussed above, the California Constitution and court decisions interpreting the Constitution also would likely constrain how ARB could charge and use revenues from a carbon fee.

Summary of Alternative 4 Strategy

Carbon fees or taxes assign a price to carbon and apply it administratively to a specific point of regulation, with the goal of encouraging emissions reduction to avoid the added cost. A fee or tax may be relatively straightforward to set and to administer, although it would be more challenging to ensure that the fee or tax achieves the required emission reductions. Moreover, taxes in theory may be levied and collected by tax authorities, rather than environmental regulatory agencies. In the case of a carbon fee, the uses of the revenues are restricted by state law, while a carbon tax approved by voters or the Legislature, revenues can be redirected to any number of potential uses, including offsetting income taxes, dividends or reducing comparably higher fuel bills to low income households that a carbon fee or tax would bring.

The most challenging constraint for a tax approach in California owes to the requirement that taxes must be approved either by legislative supermajority or voter initiative. Such measures would require time and potentially substantial resources to pass, and may be politically infeasible. Successful passage and creation turns in large part on confidence that government will use revenues wisely and return value to taxpayers or households. Importantly, while a fee or tax may be simple to administer, a central drawback is that a fee or tax addresses environmental goals or emissions limits indirectly (i.e., increasing the price of carbon, but without a specified emissions cap). Thus, there is uncertainty about whether the emission reduction target would be

met. If evidence shows that a tax is failing to sufficiently reduce emissions, it may be politically difficult to return to the Legislature or to voters to levy a higher tax to reduce more emissions (although an automatic adjustment could be included in the original authorization).

Alternative 4 Impact Discussion

Objectives

Alternative 4 would seek to reduce GHG emissions by 22 $MMTCO_2E$ through the use of a carbon fee or tax on emissions from electricity, transportation fuels, natural gas and large industrial sources. The Alternative could potentially meet the fundamental objective of reaching the 2020 emissions reduction target; however, the absence of a firm cap or performance standard creates a substantial risk of either falling short of the target or over-complying, which may involve unnecessary additional costs. Also, if the carbon fee or tax does not reflect market conditions well, either leakage to other unregulated states could occur (if the levy is too high compared to the market) or actual reductions could fall short of what is needed to meet the state's target (if the levy is too low compared to costs of changes to reduce GHG).

The achievement of other basic objectives of the Proposed Scoping Plan would be variable for Alternative 4. For instance, Alternative 4 would reduce fossil fuel use through the potential compliance responses to the fee or tax, such as reduction of operations or enhancement of energy efficiency. The co-benefits of reduced criteria pollutants and TACs would be expected within the facilities of the affected sectors. However, it is uncertain that Alternative 4 would result in the most cost-effective GHG emissions approach, because the level of the fee or tax would be set legislatively or administratively, rather than being easily adjusted to the market. Disadvantaged communities would experience benefits of reduced co-pollutants where facilities cut back on operations or achieved more energy efficiency. Most importantly, the effectiveness of the approach has substantial risk of being hindered, because of the potential for the charge to be inconsistent with marketplace conditions, either resulting in substantial leakage, which would not be consistent with the Proposed Scoping Plan objectives, or falling short of the contribution needed to the state's 2020 reduction target. If pursued, this Alternative would need to be designed to include administrative mechanisms to minimize the potential for leakage.

Environmental Impacts

Alternative 4 relies on a carbon fee or tax program that would identify affected sectors, fee or tax level, emissions basis, and point of regulation to meet the 2020 GHG emissions reduction target. The sectors affected by this Alternative would be the same as those included as covered entities in the proposed Cap-and-Trade Regulation (i.e., electricity, transportation fuels, natural gas and large industrial sources). Under this alternative, compliance responses by affected entities could include fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. For purposes of this analysis, the point of regulation of electrical generation and industrial sources would

be the facility operator (i.e., the generation or industrial facility). For electricity imports, the point of regulation would be the importer. For natural gas, the point of regulation would be the user or distributor of the gas. For transportation fuels, the point of regulation would be the first holder or supplier of refined gasoline or distillate fuel oil. Setting the cost of carbon emissions on covered entities through a fee or tax provides an indirect influence on emitters to reduce their GHG emissions sufficiently to meet the 2020 target, because there is neither a regulated cap (as in Cap-and-Trade) nor a defined performance standard (as in a direct, source-specific regulation). Defined administratively by statute and/or regulation, the carbon fee or tax would not adjust with changing market conditions (unless special provisions are included in authorizing statute or regulation for adjustment). The carbon fee or tax provides a clear, long-term signal of the price that parties will face for their GHG emissions, which allows for long-term operational planning.

Aesthetic impacts resulting from Alternative 4 would be less than significant, because compliance responses are focused on modification of existing industrial facilities and uses. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. Implementation of this Alternative would not be anticipated to result in adverse aesthetic impacts because any construction- or operational-related activities would likely occur within existing facilities, where the aesthetic character is already established and would not be substantially changed. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, aesthetic impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

Agricultural and forest impacts resulting from Alternative 4 would be less than significant, because compliance responses are focused on modification of existing industrial facilities and uses. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. Implementation of this Alternative would not be anticipated to result in adverse agricultural or forest impacts because any construction- or operational-related activities would likely occur within existing industrial areas, where important agricultural or forest resources would not be located. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, agricultural and forest impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

Air quality impacts of Alternative 4, in general, would be regionally beneficial, because measures that reduce GHG emissions also provide co-benefits in terms of reductions in regional criteria air pollutant and TAC emissions because of their similarities in source types. Thus, implementation of this Alternative would reduce statewide levels of criteria

air pollutants and TACs resulting in a beneficial effect. However, implementation of this Alternative could result in substantial leakage because the cost of carbon in a fee or tax program would be set administratively, rather than by the market, resulting in the potential to be inconsistent with marketplace conditions. Unless administrative mechanisms are in place to minimize the potential for leakage, implementation of this Alternative could result in adverse regional and local air quality impacts out-of-state associated with construction- (e.g., use of heavy-duty equipment) and operational-related (e.g., relocated facilities) increases in criteria air pollutants and TACs. However, with such mechanisms in the design of the alternative, impacts to air quality would be reduced to a level of insignificance.

Adverse biological impacts resulting from Alternative 4 could occur, if compliance responses to the fee or tax require modification of existing industrial facilities and uses where biological resources are present. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect natural habitats and sensitive species, if they are present around existing facilities. Construction, grading and trenching have the potential to adversely affect any protected biological resources that might exist at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant biology impact may be unavoidable.

Adverse cultural resources impacts resulting from Alternative 4 could occur, if compliance responses to the fee or tax require modification of existing industrial facilities and uses where archaeological or historic resources are present. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could disturb cultural resources, if they are present around existing facilities. Construction, grading and trenching have the potential to adversely affect any potentially important cultural resources that might exist at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately

implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant cultural resources impact may be unavoidable.

Energy-related effects of Alternative 4 would be beneficial, because the GHG reduction strategy of the carbon fee or tax also results in improved energy efficiency and reductions in fossil fuel use. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. These actions would reduce overall energy demand in-state, particularly related to curtailed operations, and are considered beneficial effects. However, implementation of this Alternative could result in increased energy demand out-of-state associated with leakage (e.g., shifting production out-of-state resulting in greater operational emissions). The authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects in other states. Consequently, while the net change would still be beneficial (i.e., less total energy demand), the potential level of benefit would be diminished because of the potential for substantial leakage.

Adverse geology, soils, and mineral resources impacts resulting from Alternative 4 could occur, if compliance responses to the fee or tax require modification of existing industrial facilities and uses where new ground disturbance and landscape alteration are needed. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect local geology and soils. Construction, grading and trenching have the potential to cause soil erosion, dust generation, and sedimentation of local waterways at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant geology and soils impact may be unavoidable.

GHG emissions would be expected to decrease in California with the imposition of a carbon fee or tax. This Alternative relies primarily on a carbon fee or tax program that would identify covered sectors, fee or tax level, emissions basis, and point of regulation to meet the 2020 GHG emissions reduction target. Thus, GHG-related impacts of this Alternative would be beneficial because of the fundamental objective of this program to reduce in-state GHGs. However, although implementation of this Alternative would

reduce GHGs, it is important to note that a central drawback of this type of program is that the fee or tax addresses environmental goals or emission limits indirectly (i.e., without a defined emissions cap) resulting in less certainty that such are being met (i.e., AB 32 2020 GHG emissions reduction target). In addition, implementation of this Alternative could result in adverse GHG impacts out-of-state associated with increases in GHGs from leakage (e.g., operational emissions from relocated facilities). Unless administrative mechanisms are in place to minimize the potential for leakage, implementation of this Alternative could result in adverse GHG impacts. However, with such mechanisms in the design of the alternative, impacts related to GHGs would be reduced to a level of insignificance.

Hazard and hazardous materials-related environmental impacts of Alternative 4 would be less than significant. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The use of hazardous materials is common practice in industrial settings. Implementation of compliance responses could include the use of hazardous materials, but this would be considered simply a continuation of existing business practices for the covered entities, controlled by existing practices and regulations, and, thus, considered less than significant. All projects would be required to comply with established local, state, and federal laws pertaining to the use, storage, and transportation of these materials. Assuming compliance with applicable laws and regulations, the impacts would be less than significant.

Adverse hydrology and water quality impacts resulting from Alternative 4 could occur, if compliance responses to the fee or tax require modification of existing industrial facilities and uses near local water features. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The construction related to upgrading of equipment, switching to lower intensity carbon fuels, and implementing operational changes at covered facilities could affect local drainage and discharge of contaminants to local waterways. Construction, grading and trenching have the potential to cause soil erosion and sedimentation of local surface water resources at those locations. Recognized measures are available to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this FED Supplement takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this potentially significant hydrology and water quality impact may be unavoidable.

Land use impacts of the compliance responses of Alternative 4 would be less than significant, because they would not change the fundamental use of facility sites. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities and, as such, would be consistent with the existing land use and would pose a less than significant land use and planning impact. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, land use impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

Adverse noise impacts could result from Alternative 4, because of the potential for substantial leakage of operations to other states for sectors subject to the fee or tax. Under this alternative, compliance responses by covered entities could include fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. Implementation of this Alternative would not be anticipated to result in adverse noise impacts because no major noise-generating construction- or operational-related activities would likely occur. If such were to transpire associated with onsite upgrades or process changes, they would be minor, intermittent and temporary in nature, and similar (or less) to the levels from sources that currently exist within these industrial settings. Thus, these impacts would be considered less than significant. However, under this alternative, leakage issues could result in both construction- and operational-related impacts out-of-state due to the generation of noise levels that exceed ambient conditions at existing sensitive receptors. Unless administrative mechanisms are in place to minimize the potential for leakage, implementation of this Alternative could result in adverse noise impacts out-of-state associated with construction- (e.g., use of heavy-duty equipment) and operational-related (e.g., relocated facilities.). However, with such mechanisms in the design of the alternative, impacts to noise would be reduced to a level of insignificance.

Adverse population, employment, and housing effects would not occur from the carbon fee or tax in Alternative 4, including from the operational and facility-modification compliance response projects, because the compliance activities would not substantially change socioeconomic conditions. All impacts to population, employment, and housing would be less than significant.

Public services impacts of Alternative 4 would be less than significant, because compliance responses to the fee or tax would occur at existing facility sites where public services are already provided. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. All potential impacts to public services would be less than significant. These projects would not substantially increase the level of public services beyond that already provided to existing facilities. Leakage issues could

result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, public services impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

Recreation impacts of Alternative 4 would be less than significant, because compliance responses to the fee or tax would occur at existing facility sites. The carbon fee or tax, including the expected compliance responses, would not result in increased demand for or adverse impacts to recreation resources. The affected entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities in the state. Leakage issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, recreation impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

Adverse transportation impacts could occur from Alternative 4, because of the potential for substantial leakage of operations to other states for sectors subject to the fee or tax, resulting in the potential need for additional transportation of affected products. Under this alternative, compliance responses by covered entities could include fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, curtailing operations because of increased cost, and implementing maintenance and process changes at existing facilities. Implementation of this Alternative would not be anticipated to result in adverse transportation or traffic impacts because no major traffic-generating construction- or operational-related activities would likely occur. If such were to transpire, any increases due to construction traffic would be temporary and mitigated through ingress and egress controls, traffic controls, and reduced speed zones to ensure safety; and operational traffic levels would be similar to existing conditions. Thus, these impacts would be considered less than significant. However, under this alternative, leakage issues could result in both construction- and operational-related impacts out-of-state due to the generation of traffic. Unless administrative mechanisms are in place to minimize the potential for leakage, implementation of this Alternative could result in adverse transportation impacts out-of-state associated with construction- (e.g., use of heavy-duty equipment) and operational-related (e.g., relocated facilities). However, with such mechanisms in the design of the alternative, impacts to transportation would be reduced to a level of insignificance.

Utility and service system impacts of Alternative 4 would be less than significant, because compliance responses to the fee or tax would occur at existing facility sites where utility systems are already provided. Under this alternative, compliance responses to the fee or tax by affected entities could include the fee or tax payment, but also upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. These projects would not increase the level of utilities beyond that already provided to existing facilities. The availability and extension of utilities is subject to approval of the local utility provider, and readily implemented in a manner that would be less than significant. Leakage

issues could result in both construction- and operational-related impacts out-of-state; however, these changes would again generally be expected to occur within existing industrial areas. Consequently, utility and service system impacts resulting from compliance responses to a carbon fee or tax would be less than significant.

2.7 Alternative 5: Adopt a Variation of the Combined Strategies or Measures

Goal of Alternative 5

The goal of Alternative 5 is to describe a reasonable variation of the components of the Proposed Scoping Plan reduction measures. It is intended to help decision-makers consider whether modifying the mix of reduction strategies would reduce or otherwise substantially change potential effects on the environment.

Role of Alternative 5 in the Range of Alternatives

The role of Alternative 5 in the range of alternatives is to assess whether the number and magnitude of environmental effects would be sensitive to varying the mix of reduction measures. Instead of adopting all the reduction measures in the Proposed Scoping Plan or a set of measures oriented to a specific, primary strategy (e.g., Cap-and-Trade, source-specific regulation, or carbon fee or tax, as described in other action alternatives), ARB could adopt some of the measures or a different mix of them. Numerous variations could be implemented when considering different subsets and/or combinations of the measures identified in the Proposed Scoping Plan. It is not feasible or meaningful to examine the numerous potential Alternative combinations in detail; too many different permutations exist. However, identifying a reasonable, Alternative combination of measures would illustrate whether the number and magnitude of environmental effects would be influenced substantially by altering the combination of measures.

Precedents or Examples of the Approach in Alternative 5

British Columbia

British Columbia has prepared a Climate Plan and is developing a multi-faceted climate program that includes comprehensive strategies and initiatives that will substantially reduce GHG emissions by 33 percent by 2020. The Climate Plan program includes some measures that are in the Proposed Scoping Plan, but differs in other substantial ways. British Columbia's Climate Plan includes a carbon tax, which has been in place since 2008, and a proposed cap-and-trade program that will be voted on in the near future. Incentive programs for energy efficiency are already being implemented. The carbon tax is applied to all fuels, except for bunker, aviation and marine vessel fuels. The cap-and-trade program would cover industrial sources and electricity. In-province electricity is generated largely from hydro and biomass facilities. Similar to California's proposed Cap-and-Trade Regulation, biomass emissions are exempted.

The Climate Plan positions British Columbia to benefit from growth in demand for high technology and clean energy products and services while addressing climate action in four key areas:

- Entrenching GHG reduction targets in law.
- Taking targeted action in all sectors of British Columbia's economy.
- Taking steps to help British Columbians adapt to the realities of climate change.
- Educating and engaging British Columbians on climate action.

The Plan highlights the revenue-neutral tax on pollution as a significant piece of climate action legislation which requires industry and individuals alike to pay the same rate on the purchase and use of fossil fuels. As a result of the Carbon Tax, individual British Columbians will see their personal income taxes reduced by two percent in 2008, rising to five percent in 2009 on taxable income up to $70,000. This will mean British Columbians pay the lowest provincial income tax on earnings up to $111,000. Every dollar raised by the revenue-neutral carbon tax will be returned to individuals and businesses through tax reductions. Failure to do so will result in a financial penalty for the Minister of Finance.

The Plan describes the three-year, $60 million LiveSmart BC Efficiency Incentive Program, and lays out strategies specific to seven sectors:

- Transportation – Improved vehicle efficiency, vehicle scrapping, less tax on efficient vehicles, cleaner buses and trucks, reduced fuel carbon and expanded transit and cycling.
- Buildings – A Green Building Code, Energy Efficient Buildings Strategy, encouraging compact, green communities, and solar roofs on 100,000 BC buildings.
- Waste – Turning waste into energy, cleaning up landfills, increased composting, and making manufacturers more responsible for waste created by their products.
- Agriculture – Digesters to capture methane from manure, improved fertilizer application, community biomass projects, research on biomass fuels and green city farms.
- Industry – A carbon emissions cap-and-trade system to provide an incentive for large emitters to reduce their emissions, often by implementing made-in-BC solutions.

- Energy – PowerSmart incentives, a First Nations and remote community clean energy, Alternative energy development, solar energy, smart meters, BC Bioenergy Strategy.

- Forestry –Forests for Tomorrow, Trees for Tomorrow, accelerated forest growth and net-zero deforestation, bio-mass energy and cellulosic ethanol production (British Columbia 2008).

Stakeholder Contributions

During the Proposed Scoping Plan development, several committees and stakeholder groups offered recommendations for different approaches, including a "three-faceted approach", which involved a combination of regulations and standards, incentives, and a price on carbon (i.e., a carbon fee or tax). Also proposed was a mix of approaches that includes performance standards, a price on carbon, and targeted incentives. Although the attributes of Alternative 5 are not the same as the committees' recommendations, they serve as an example of a variation in the mix of strategies to consider when defining the reasonable set of measures included in Alternative 5.

Attributes of Alternative 5

Alternative 5 represents a suite of strategies rather than a single alternative. Instead of adopting all the measures identified in the Proposed Scoping Plan, ARB could adopt some of them or a different mix of them. Numerous alternatives exist to adopt various subsets and mixes of the measures identified in the Proposed Scoping Plan, and for the purposes of this analysis, ARB considered taking a three-faceted approach to reducing GHGs: a cap-and-trade system, a combination of regulation and standards, and putting a price on carbon via a carbon fee or tax. Further, for purposes of comparison, ARB examined a mix of traditional regulations, such as a direct regulation for light duty vehicles; a Cap-and-Trade Program for large sources that covers large stationary sources, electricity, refineries, and cement; and a fee on emissions from fuels not under Cap-and-Trade that includes transportation fuels and commercial and residential combustion.

Attributes of each component of this Alternative are individually described in Alternatives 2, 3, and 4.

Alternative 5 builds upon the No-Project Alternative (Alternative 1) by adding:

- a direct regulation that has been defined as technologically feasible and is expected to be cost-effective;

- a cap-and-trade approach for large industrial sources and electricity generation; and

- carbon fees on the transportation, commercial, and residential fuel sectors.

The application of a set of regulations, fees, and a Cap-and-Trade Program to other combinations of source categories is possible. The approach was selected based on the following reasoning:

- Direct regulations are preferred in cases where there is a high likelihood that cost-effective emission reduction technologies can be applied in a relatively uniform manner across the spectrum of sources affected.

- A cap-and-trade approach is most appropriate for those sources that are not good candidates for direct regulation, but can exercise a substantial degree of control over their emissions and/or usage in response to a cap-and-trade system. Under this approach facility operators have the flexibility to weigh the cost of reductions versus the cost of obtaining emission allocations and chose the less costly compliance option.

- A carbon fee approach is most appropriate for the remaining fuel combustion-related categories. In these categories, the regulated entity, such as a supplier of transportation fuels, has limited influence over the amount of fuel consumed. Under these conditions the principal impact of a cap-and-trade approach would be to gain reductions because as fuel prices increase to reflect the cost of carbon allowances. As described in Alternative 4, a fee approach would incentivize reductions in GHG levels, but the level of that reduction is less than certain than a cap.

Because most of the sources that could be best governed by direct regulations and meet the criteria described above are already included in Alternative 1, the new direct regulation element of Alternative 5 is limited to one major regulation, the ARB's advanced clean cars program. This program consists of strengthening clean cars standards for new vehicles produced between 2017 to 2020 to achieve an additional 3.8 $MMTCO_2E$ of reductions by 2020.

The second element of Alternative 5 would be the application of a cap on the large source emission sector which consists of larger industrial sources and electricity generation facilities. (See Alternative 2 for more detail on the cap-and-trade approach) Collectively these sources are projected to emit about 192 $MMTCO_2E$ in 2020 in ARB's most recent baseline forecast (ARB 2010e). Measures included in Alternative 1 are estimated to reduce emissions in 2020 to about 172 $MMTCO_2E$. The cap for the sources covered by the second element would be set at about 157 $MMTCO_2E$ in order to meet the 2020 emissions limit (427 $MMTCO_2E$) established pursuant to AB 32. The derivation of the level of the cap is predicated on obtaining 7.2 MMTs from other elements of Alternative 5 (see Table 2.7-1 for more detail).

The final element of Alternative 5 would be the application of an emissions fee on transportation fuels, residential and commercial fuels and on fuels used by smaller industrial sources not subject to the cap. (See Alternative 4 for more detail on the emission fee approach.) Collectively, these sources are projected to emit about

229 $MMTCO_2E$ in 2020 in ARB's most recent baseline forecast. Measures included in Alternative 1 and from an advanced clean cars program are estimated to reduce emissions in 2020 to about 204 $MMTCO_2E$. Under these elements, an emissions fee of $50 per MT would be assumed, and is estimated to produce reductions on the order of 1.7 percent – about 3.4 $MMTCO_2E$ in 2020. Table F-12 in Appendix F of the Cap-and-Trade Regulation statement of reasons estimated that a $60 per MT allowance price would produce a 2 percent decrease in gasoline use (ARB 2010a). Based on this information, an estimated reduction of 1.7 percent was made for a $50 per MT fee. A similar percent reduction was assumed for all transportation fuels and for natural gas usage, as well.

The emission reductions and remaining emissions estimated from implementing Alternative 5 are shown below in Table 2.7-1.

Table 2.7-1 Summary of Emission Effects from Alternative 5

Strategy Category	2020 Emissions MMTs(1)	Emission Reductions MMTs - 2020	Remaining Emissions in 2020
Direct Regulation (Advanced Clean Cars)		3.8	N/A
Sources in Cap & Trade	182	15	167
Fuels Subject to Fees	204	3.4	197(2)
Remaining Sources(3)	63	None	63
Totals	449	22.2	427

Notes:
[1] After measures included in Alternative 1 are accounted for and rounded to no more than three significant figures.
[2] Includes reductions from direct regulations, Advanced Clean Car Program.
[3] Includes high GWP gases, Agriculture and Forestry.

Collectively, the elements in Alternative 5 are designed to achieve the 2020 emission target set by AB 32.

Alternative 5 Impact Discussion

Objectives

Alternative 5 would be expected to be able to meet the fundamental objective of reaching the 2020 emissions reduction target. The Proposed Scoping Plan Cap-and-Trade Program was designed to reduce GHG emissions by 18 $MMTCO_2E$, so achieving a contribution of 15 $MMTCO_2E$ in this Alternative would also be feasible. The advanced clean car program has received initial evaluation by ARB sufficient to support the feasibility of a 3.8 $MMTCO_2E$ contribution. The application of a carbon fee to transportation fuels is estimated to secure a 3.4 $MMTCO_2E$ contribution, which is only 1.5 percent of the current emissions from that sector. It would be reasonable to expect that this combination of measures could achieve the 2020 GHG reduction target.

The achievement of other objectives of the Proposed Scoping Plan would also be generally expected by Alternative 5, because it uses a combination of market-driven GHG reduction strategies and direct regulations. For instance, it would reduce fossil fuel use through encouragement of decreased fuel consumption resulting from the advanced clean car program and fuel fee and from fuel switching in compliance responses to the Cap-and-Trade Program. Emissions reductions would be generally ensured by the establishment of the mandatory, declining cap for the majority of the reductions. Reductions would be expected to occur in the most cost-effective manner, because the cost of reductions or the cost of allowances that can be purchased are determined by the market under the Cap-and-Trade component, and the advanced clean car program uses performance standards that allow flexibility in specific strategies to achieve them. Leakage would be minimized by the market-driven pricing of carbon and the availability of lower cost offsets for a portion of the reductions to help manage allowance prices from the Cap-and-Trade Program. Limiting the carbon fee to transportation fuel would minimize leakage, as well, compared to levying a fee or tax on industrial sectors. However, with a pass-through of a transportation fuel fee, fuel costs for consumers would increase, which could increase cost burden on disadvantaged communities. Many co-benefits would occur with an effective market-driven GHG reduction program and advanced clean car program, such as energy conservation and efficiency, reduced fossil fuels use, reduction of regional co-pollutants, and job-forming economic opportunities related to facility modifications and development of energy efficiency and vehicle technologies.

Environmental Impacts

Alternative 5 focuses on a combination approach to meeting the 2020 GHG reduction target, by drawing elements of the strategy from Alternatives 2, 3, and 4. The Cap-and-Trade Program drawn from Alternative 2 is designed to reduce GHG emissions sufficiently to achieve a 15 $MMTCO_2E$ reduction by 2020, including compliance responses by covered entities and use of offsets according to specified protocols. For this component of the alternative, compliance responses by covered entities could include upgrading equipment, switching to lower intensity carbon fuels, implementing maintenance and process changes at existing facilities, and reducing operations of carbon-intense facilities in favor of increased operations of more carbon-efficient facilities. Implementation of carbon offset programs under specified protocols could also occur. The four offset protocols proposed as part of the Scoping Plan's Cap-and-Trade Program would also be applicable for this alternative: Ozone Depleting Substances (ODS), Livestock, Urban Forest, and Forest. Construction-related activities associated with these compliance responses could occur. The general approach, covered entities, and offset protocols of a Cap-and-Trade Program under Alternative 5 would be reasonably expected to be similar to the Proposed Scoping Plan's Cap-and-Trade Program, except that the reduction target would be decreased from 18 to 15 $MMTCO_2E$.

This Alternative includes a source-specific emissions regulation through the adoption of the advanced clean car program currently being evaluated by ARB. An assessment of the program has been developed to evaluate its feasibility and emissions reduction expectations (U.S. EPA, U.S. DOT, and ARB 2010). By regulation, ARB would seek to reduce GHG emissions by 3.8 $MMTCO_2E$. The program would establish more stringent tailpipe and GHG emission standards for new passenger vehicles. Combining the control of criteria pollutants and GHG emissions into a single coordinated package of standards is a new approach to ARB's motor vehicle standards. The new approach also includes efforts to support and accelerate the numbers of plug-in hybrids and zero-emission vehicles in California. Compliance responses to the program would involve improved engine and transmission technologies, vehicle technologies, mass reduction, electrification and accessory technologies, and electric drive technologies including hybrid technologies. The improvements in vehicle technology would result in greater use of electricity and fuel cells for powering vehicles and construction of Alternative fueling stations to serve plug-in hybrid, battery electric vehicles, and fuel-cell vehicles.

The third component of Alternative 5 would be a carbon fee levied on transportation fuels. The compliance responses to this measure would be expected to include reduced consumption of fossil fuels and fuel switching away from the affected transportation fuels.

The environmental impacts of this combination of strategies would be similar to the conclusions presented in Alternatives 2, 3, and 4 for the analogous components in Alternative 5. Rather than repeat the previously presented impact discussions for the Cap-and-Trade Program (please refer to Alternative 2), direct regulation strategies (please refer to Alternative 3), and carbon fee measure (please refer to Alternative 4), a summary discussion will be provided for the environmental impacts of the specific features of this Alternative not emphasized in the earlier.

The environmental effects of Alternative 5 would primarily involve a combination of the potential impacts of compliances responses to a Cap-and-Trade Program and the impacts of the Advanced Clean Car Program. The fee on transportation fuels in this Alternative would not be expected to result in significant environmental impacts, because the compliance response would consist of fuel switching, probably using facilities and infrastructure that are already in place or would need relatively minor modification. The environmental effects of a Cap-and-Trade Program are related primarily to compliance responses that involve potential construction-related impacts to sensitive resources, if they are present at construction sites, along with the remote possibility of localized air quality impacts, if covered entities shifted production to more carbon-efficient units, or of land use plan conflict of avoided forest conversion where local plans call for development (see discussion under Alternative 2). The potential environmental effects of the advanced clean car program component of Alternative 5 relate primarily to how to serve the changes in fuel sources for vehicles and the greater use of batteries and fuel cells. Construction of new or modified fueling stations could result in environmental impacts to resource-related issues, such as biological resources,

cultural resources, geology and soils, hazardous materials, and hydrology and water quality, if sensitive resources are present on or near the construction locations. If these resources were present and adversely affected, the impact may be potentially significant, similar to the construction-related conclusions for facility modifications expected in response to other GHG reduction measures. Land use related impacts would likely be less than significant, because the location and design of fueling stations would need to comply with local land use plans and zoning. Therefore, less-than-significant aesthetic, agriculture and forest resource, noise, socioeconomics, traffic/transportation, public services, utilities, recreation, and land use and planning effects would be expected.

Air quality, GHG, and energy demand impacts of the advanced clean car program would be beneficial, because the program seeks to combine strategies that control and reduce criteria pollutants and GHG together, which would also lead to reduced fossil fuel use and reduced energy demand for the affected motor vehicles. Propulsion would rely more on power from the electricity grid, which would be a beneficial fuel switch for air quality and GHG emissions as the renewable portfolio of electricity generation continues to transition toward the 33-percent RPS. The increased use of vehicle batteries and fuel cells would increase their production, storage, recycling, and ultimately disposal. An increase of batteries and fuel cells in the waste stream could result in potential hazardous materials and water quality effects; however, regulations exist for handling of hazardous materials and protection of water quality from waste disposal facilities and ARB is also considering specific regulatory requirements for further protection in the advanced clean car program design.

2.8 Comparison of the Proposed Scoping Plan, Project Alternatives, and their Environmental Tradeoffs

Each of the alternatives discussed in Section 2.0 of the FED Supplement possess environmental advantages and disadvantages. These advantages and disadvantages were discussed in more detail in the subsections devoted to each alternative. A summary of the preceding discussions is presented below to help the reader understand the most important differences among the alternatives, in terms of achievement of environmental objectives or potential for significant environmental impacts.

With the exception of Alternative 1, No-Project, all of the project alternatives are designed to cover the 22 $MMTCO_2E$ reduction shortfall needed to achieve the AB 32-mandated GHG reduction target of 1990 levels by 2020 that would occur if the Proposed Scoping Plan was not implemented. The likelihood of reaching this target would be high for Alternative 2, Cap-and-Trade, and Alternative 5, Combined Strategy, because they include a market-based approach for covered sectors shown to have technologically feasible ways to reduce GHG and the opportunity to use offsets or purchase allowances from others to enhance cost-effectiveness through flexibility and choice of reduction strategies. Because of the potential for substantial leakage, there is a reduced likelihood that Alternative 3, Direct Source-Specific Regulation, or

Alternative 4, Carbon Fee or Tax, would achieve the target. Both strategies could be effective in reducing in-state GHG emissions, but could cause adverse GHG emissions impacts elsewhere in unregulated states, if substantial shifting of operations out-of-state occurred. All the action alternatives would create at least some benefits related to reduced GHG emissions, reduced regional criteria co-pollutants and TACs, and energy demand, compared to existing conditions.

Because Alternative 1, No-Project Alternative, does not reach the reduction target mandated by AB 32, it would not be environmentally advantageous compared to the Proposed Scoping Plan or the other action alternatives. Already implemented or ongoing measures in Alternative 1 include the sources of a major proportion of the potential significant environmental impacts of the full Proposed Scoping Plan, specifically utility-scale renewable energy projects and the high-speed rail project. Therefore, Alternative 1 would incur the majority of the environmental impacts of the Proposed Scoping Plan, but would not achieve the GHG reduction benefit needed to comply with AB 32.

Alternative 2, which uses a Cap-and-Trade Program to achieve the 22 $MMTCO_2E$ reduction shortfall, would result in environmental impacts similar to the Proposed Scoping Plan, where Cap-and-Trade is also a central feature, and also somewhat similar to Alternative 5, Combined Approach (including Cap-and-Trade). The Cap-and-Trade Program offers an effective approach for achieving the AB 32 goals, so GHG-reduction benefits of Alternative 2 would be similar to the Proposed Scoping Plan. Potential significant environmental impacts are identified for Alternative 2, including the remote potential for localized air quality impacts, construction-related impacts of covered entities' compliance responses, and environmental effects of certain elements of the offset protocols (such as construction impacts related to livestock digesters and possible local land use planning conflicts from avoided forest conversion where local plans call for development). Compared to other action alternatives, the Proposed Scoping Plan and Alternative 2 present environmental trade-offs, because the Cap-and-Trade Program compliance responses and offset protocols could result in certain significant environmental impacts that other alternatives would not cause, while the Proposed Scoping Plan's and Alternative 2's effectiveness in reducing GHG and creating attendant air quality co-benefits would be stronger than Alternative 3 (Direct Regulation) or 4 (Carbon Fee or Tax), because of the lesser risk of leakage. Also, the smaller risk of leakage means that Proposed Scoping Plan and Alternative 2 would not have the potential for out-of-state environmental impacts, as either Alternative 3 or 4 would have.

Alternative 3, the source-specific regulatory approach, would result in some environmental impacts similar to the Proposed Scoping Plan, such as the construction- related environmental effects where compliance responses by industrial and electricity sources include changes or additions to facilities where sensitive resources may be present. Alternative 3 could result in significant additional environmental impacts from the potential for construction of electricity generation facilities using less carbon-intensive fuels than coal (such as combined-cycle, natural

gas power plants). If new power plants were built, the impacts would likely take place outside California, because the siting, permitting, and construction of new electricity generation facilities in the state would be challenging in time to help achieve the 2020 target. Also, the advanced clean car program could result in environmental impacts related to construction of fueling stations and the increased use and ultimately disposal of batteries and fuel cells. The direct-regulation approach offers an effective strategy for reducing in-state GHG emissions, but may not achieve the AB 32 reduction target, because of the potential for substantial leakage. Compared to the Proposed Scoping Plan and other action alternatives, Alternative 3 presents environmental trade-offs, because the substantial leakage risk could cause out-of-state impacts not expected from the Proposed Scoping Plan or Alternatives 2 and 5; however, Alternative 3 does not include the use of offsets and their associated environmental impacts that occur with the Proposed Scoping Plan, Alternative 2, and Alternative 5. Alternative 3's effectiveness in reducing GHG and creating attendant air quality co-benefits would be less than the Proposed Scoping Plan, Alternative 2 (Cap-and-Trade), and Alternative 5 (Combined Approach), and similar to Alternative 4 (Carbon Fee or Tax), because of the risk of leakage in response to direct regulations.

Alternative 4, the carbon fee or tax approach, would also result in some environmental impacts similar to the Proposed Scoping Plan, such as the construction-related environmental effects where compliance responses by industrial and electricity sources include changes or additions to facilities where sensitive resources may be present. The carbon fee or tax approach offers a potentially effective strategy for reducing GHG emissions, but administrative challenges and legal constraints exist for fees and taxes in California that could constrain ARB's ability to implement such a program. Compared to the Proposed Scoping Plan and other action alternatives, the impacts of Alternative 4 would be similar to the Proposed Scoping Plan, Alternative 2, and Alternative 5 in most ways, except that Alternative 4 does not include the use of offsets with their associated environmental impacts. Alternative 4's effectiveness in reducing GHG and creating attendant air quality co-benefits would be similar to the Proposed Scoping Plan, Alternative 2 (Cap-and-Trade), and Alternative 5 (Combined Approach), and better than Alternative 3 (Direct Regulation), because of Alternative 3's risk of leakage in response to direct regulation.

Achievement of the Proposed Scoping Plan's project objectives varies among the alternatives, as well. Table 2.8-1 presents a summary of the likelihood of meeting the objectives presented in Section 1.2. The table represents a general summary, supported by analysis and discussion in the 2008 Scoping Plan FED, Cap-and-Trade FED, and this FED Supplement.

Table 2.8-1 Comparative Likelihood That Alternatives Achieve Project Objectives

KEY:
L (low) = No or low likelihood to achieve objective
M (medium) = Medium likelihood of achieving objective
H (high) = High likelihood to achieve objective

	ALTERNATIVES	Proposed Scoping Plan	# 1 No Project	# 2 Cap-and-Trade	# 3 Direct Regul.	# 4 Carbon Fee/Tax	# 5 Combo.
OBJECTIVES	1. Achieve reductions	H	L	H	M	M	H
	2. Reduce fossil fuel use	H	L	H	H	H	H
	3. Link with partners	H	L	H	L	L	H
	4. Enforceable, amendable program	H	L	H	H	H	H
	5. Ensure emissions reductions	H	L	H	H	M	H
	6. Technologically feasible, cost effect.	H	L	H	L	L	H
	7. Avoid disproportionate impacts	H	L	H	H	M	H
	8. Credit early action	H	L	H	H	L	H
	9. Complement existing air standards	H	L	H	H	H	H
	10. Consider a broad range of benefits	H	L	H	H	H	H
	11. Minimize administrative burden	H	L	H	M	H	H
	12. Minimize leakage	H	L	H	L	L	H
	13. Weigh relative emissions	H	L	H	H	H	H
	14. Achieve real emissions reductions	H	L	H	H	H	H
	15. Achieve incremental reductions over	H	L	H	H	H	H
	16. Complement direct measures	H	L	H	H	H	H
	17. Consider emissions impacts	H	L	H	H	H	H
	18. Prevent increases in other emissions	M	L	M	H	M	M
	19. Capture co-benefits	H	L	H	H	H	H
	20. Avoid duplication	H	L	H	H	H	M

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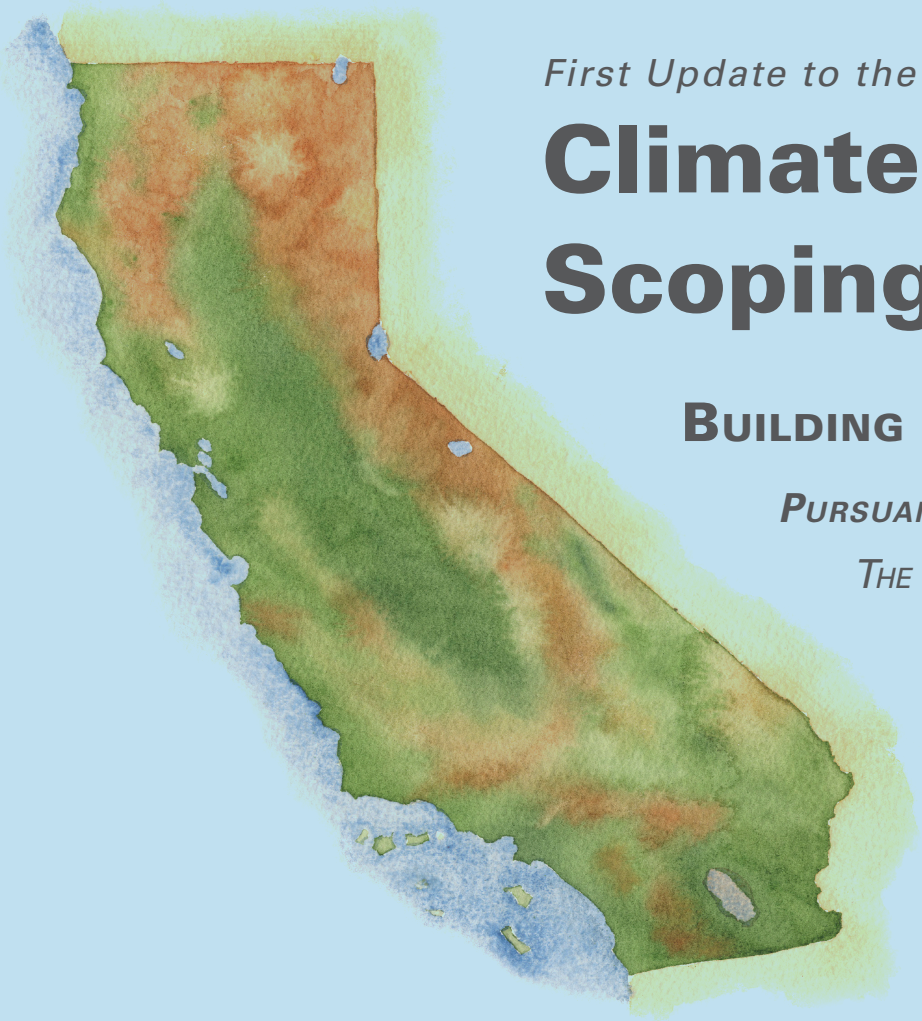
Appendix 5.7D

First Update to the Climate Change Scoping Plan

California Environmental Protection Agency and
Air Resources Board
May 2014

May 2014



First Update to the

Climate Change Scoping Plan

Building on the Framework

Pursuant to AB 32

The California Global Warming Solutions Act of 2006

First Update to the

Climate Change Scoping Plan

Building on the Framework

Pursuant to AB32
The California Global Warming Solutions Act of 2006

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Governor

Matt Rodriquez
Secretary, California Environmental Protection Agency

Mary D. Nichols
Chairman, Air Resources Board

Richard W. Corey
Executive Officer, Air Resources Board

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Executive Summary

California is a collection of farmers, surfers, factory workers, outdoor enthusiasts, tech geeks, truckers, world-class researchers, celebrity actors, and many more—who come from all around the world to live and work in one of the most beautiful, vibrant, and ecologically and culturally diverse places on Earth. We are sustained, in more ways than one, by the mountains, deserts, rivers, streams, forests, farmlands, rangelands, coastline, and temperate climate that form our natural environment and characterize our great State.

These resources, and their natural beauty, enable our continued economic and cultural growth. They attract a wide array of businesses and workers who want to live here. They are a primary reason that California is: the eighth largest economy in the world; home to the most small businesses, Fortune 500 companies, and fastest-growing businesses in the United States; the national leader in global trade and direct investment; and tops in the United States in many economic sectors, including agriculture, biotech, clean energy, entertainment, high-tech, manufacturing, tourism, and more.

Accordingly, Californians of all backgrounds and political persuasions have supported policies and planning to protect our natural environment and the high quality of life it provides. The result is a decades-long, broad commitment to ensuring clean air and water, an efficient and productive use of energy and resources, a healthy workforce, and vital cities and towns. Our collective will to protect the environment is a valuable resource in itself, whose benefits enhance economic growth and prosperity in our state and help shape California's distinct identity.

With climate change threatening our resources, economy, and quality of life, California is squarely focused on addressing it and protecting our natural and built environments. Just as California has done dozens of times before on other environmental issues, it is leading on climate change, with an approach that will enable better, lasting economic growth and allow the California lifestyle to endure.

The 2006 adoption of Assembly Bill 32 propelled California further into an international leadership role in the fight against global climate change. By building on decades of successful actions to cut pollution and promote cleaner and more efficient energy, AB 32 solidified California's commitment to tackling climate change in a comprehensive way.

Since 2006, the State has continued to steadily implement a set of actions that are driving down greenhouse gas (GHG) emissions, cleaning the air, diversifying the energy and fuels that power our society, and spurring innovation in a range of advanced technologies. These efforts have put California on course to achieve the near-term 2020 emissions limit, and have created a framework for ongoing climate action that can be built upon to maintain and continue reductions beyond 2020 as required by AB 32.

California's approach to climate change is not simply about reducing greenhouse gas emissions. It is built upon the principle that economic prosperity and environmental sustainability are one and the same. And it continues the State's long and successful legacy of building a world-class economy in concert with some of the most effective environmental and public health policies on the planet.

By remaining steadfastly committed to this approach, we can not only do our part to tackle climate change, we can also forge a cleaner, healthier, and more sustainable future for all Californians.

In the words of Governor Brown, our collective challenge is to "build for the future, not steal from it." That is what this Plan is designed to do.

First Update to the Climate Change Scoping Plan

This First Update to California's Climate Change Scoping Plan (Update) was developed by the Air Resources Board (ARB) in collaboration with the Climate Action Team and reflects the input and expertise of a range of state and local government agencies. The Update reflects public input and recommendations from business, environmental, environmental justice, and community-based organizations provided in response to the release of prior drafts of the Update, a Discussion Draft in October 2013 and a draft Proposed Update in February 2014.

Progress to Date

California is on track to meet the near-term 2020 greenhouse gas limit and is well positioned to maintain and continue reductions beyond 2020 as required by AB 32. The set of actions the State is taking is driving down greenhouse emissions and moving us steadily in the direction of a cleaner energy economy. Many of these actions have been bold, ambitious, and truly trail-blazing. Some are more recent, while others precede the passage of AB 32.

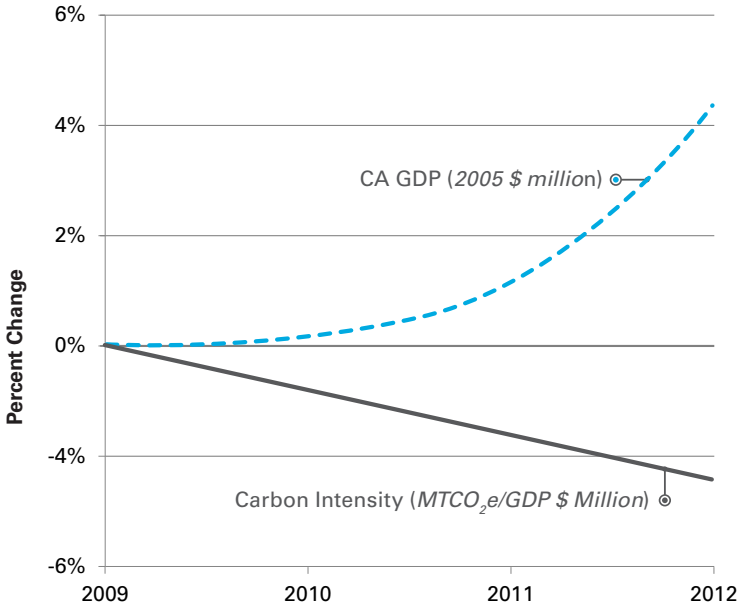
Collectively, these actions are evidence of California's ability to show that it is possible to break the historical connection between economic growth and associated increases in energy demand, combustion of carbon-intensive resources, and pollution. We have shown it is possible to break this chain by relying on cleaner technologies, more efficiency, and more renewable energy sources. And we know that preventing the worst impacts of climate change will require accelerated development and diffusion of these technologies across the world. Stable, flexible, yet durable policies like those developed under AB 32 are key.

Cleaner and More Efficient Energy

California continues to be a global leader in energy efficiency. Since energy efficiency efforts began 40 years ago, Californians have saved $74 billion in reduced electricity costs. As the State's first priority for providing for its energy needs, ongoing efficiency efforts—like new green building standards now in effect for homes and businesses and new standards for appliances, televisions, and other "plug loads"—continue to reduce energy use and emissions, make our businesses and economy more efficient, and cut energy costs.

California has also made tremendous strides in harnessing its abundant renewable energy resources. Currently, about 23 percent of the State's electricity comes from renewable power. This will increase to at least 33 percent by 2020 under new requirements set in place by Governor Brown and the Legislature in 2011. Renewable energy is rapidly coming down in cost and is already cost-effective in California for millions of homes and businesses, and in certain utility applications. Once thought of as exotic and alternative, renewable energy technologies have now become an integral part of California's energy mix.

Figure ES1: 2009-2012 CA GDP & Carbon Intensity Trends



'Carbon Intensity,' the amount of carbon pollution related to the State's economy, has fallen steadily over the last three years. California is getting more economic growth for each ton of greenhouse gases emitted overall.

Source: DOF & 2012 GHG Inventory

Cleaner Transportation

California has taken a number of innovative actions to cut emissions from the transportation sector. Collectively, the State's set of vehicle, fuels, and land use policies will cut in half emissions from passenger transportation and drivers' fuel costs over the next 20 years.

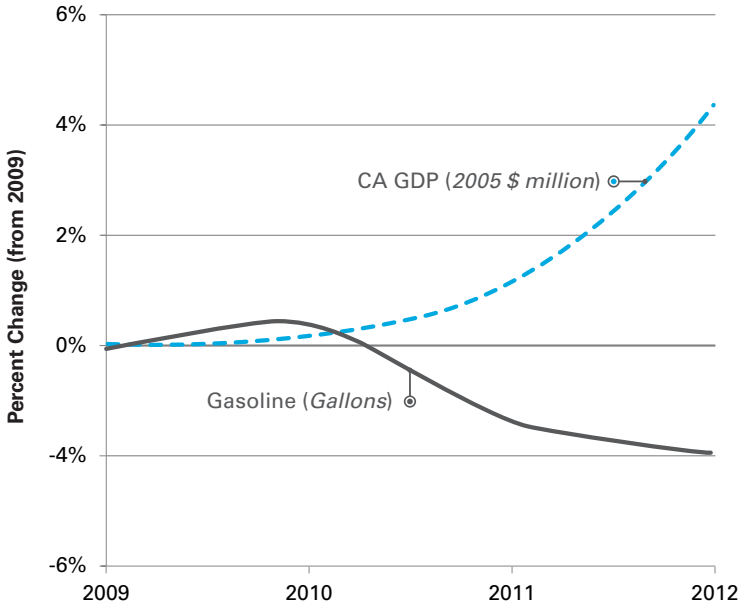
California's Low Carbon Fuel Standard (LCFS) is beginning to drive the production of a broad array of cleaner fuels. Since its launch in 2011, the regulation has generated a multitude of unique approaches for cleaner fuels. The LCFS is driving the necessary transition to cleaner fuels and is providing California businesses and consumers with more choices for the fuels they use. Companies in California and elsewhere are rising to the challenge by finding innovative ways to produce cleaner, low carbon fuels.

The cars on California's roads are also undergoing a transformation. California's vehicle GHG standards—authorized by AB 1493 (Pavley) in 2002, first approved in 2004, and extended in 2012—are delivering both carbon dioxide (CO_2) reductions and savings at the pump. These standards are now federal law and the benefits of California's policies will be realized nationwide, dramatically scaling up emission reductions. The transition to a fleet of lower-emitting, more-efficient vehicles in California will continue beyond 2020, as these rules cover model years through 2025, and turnover of the fleet will deliver additional benefits from these rules for many more years. Most recently, ARB is working with the U.S. EPA and the U.S. Department of Transportation's National Highway Traffic and Safety Administration (NHTSA) on national GHG standards and corresponding fuel efficiency standards for medium- and heavy-duty trucks.

California's pioneering zero emission vehicle (ZEV) regulation is also driving a transformation of the fleet. As a result of ARB's ZEV program and Governor Brown's Executive Order B-16-12, California will see 1.5 million zero emission vehicles on the State's roads by 2025. Each day, more and more zero emission vehicles and cleaner, more efficient cars are driving on our streets and highways—visible signs of the transformation of California's transportation sector.

California is also making major strides toward reducing the number of miles people drive, through more sustainable local and regional housing, land use, and transportation planning. To date, seven Metropolitan Planning Organizations have adopted Sustainable Community Strategies. In addition to helping drive GHG emission reductions, these plans will help create more livable communities that offer greater housing and transportation options; improved access to resources and services; safer, more vibrant neighborhoods; and healthier lifestyles where people can live, work, and play without having to travel long distances or sit through congestion.

Figure ES2: 2009-2012 CA GDP & ON-Road Gasoline Use Trends



The amount of gasoline used in California has steadily declined since 2009 while the the State's economy grew by five percent over the same time period.

Source: DOF & BOE

Cap-and-Trade Program

Last year, California successfully launched the most comprehensive greenhouse gas Cap-and-Trade Program in the world. As the emissions cap is gradually reduced over time, and as additional sources are brought under the cap to include the vast majority of emissions in the State, the program will ensure that California remains on track to continually reduce emissions and meet the 2020 limit. Looking out into the future, the Cap-and-Trade Program will play a critical role in keeping California on the right emissions reduction trajectory to meet ongoing reduction targets at the lowest possible cost. The program is also sending a clear signal that investment in clean, low carbon technologies will pay off. This includes the millions of households and small business customers of the State's largest electric utilities who will see a twice a year "Climate Credit" on their electricity bills. In April 2014, this credit averaged $35 throughout the State. Investing this credit in simple items that improve energy efficiency, such as energy efficient LED light bulbs, can help customers save even more.

On January 1, 2014, California linked its Cap-and-Trade Program with Québec's. By successfully linking cap-and-trade programs across jurisdictions and increasing opportunities for emission reductions, this linkage represents another important step in California's efforts to collaborate with other partners around the globe to address climate change.

Building on the Framework

Through AB 32, California has established an effective framework for climate action. This Update includes an in-depth discussion of climate change science, reflecting the Intergovernmental Panel on Climate Change's recently released Fifth Assessment and input from a distinguished team of scientific expert reviewers. The science clearly highlights the need for action—greenhouse gas emissions must be cut 80 percent below 1990 levels by mid-century to stave off the worst impacts of climate change. Setting a mid-term target and sector-specific targets will help guide our path.

Reaching our ultimate objective—reducing California's greenhouse gas emissions to the scientifically recognized level necessary for climate stabilization— will require California to keep building on the framework by continuing to pursue the maximum technologically feasible and cost-effective actions that will steadily drive down greenhouse gas emissions over the coming decades. It is also clear that many of these same actions are needed to reduce emissions of smog-forming and toxic pollutants to meet federal air quality requirements and ensure that all Californians have healthful air.

This Update lays out a set of new actions that will move the State further along the path to a low-carbon, sustainable future, including specific recommended actions with lead agency assignments and anticipated due dates. Some of the actions are near-term, while others are focused on longer-term efforts that will provide major benefits well into the future.

Every major economic sector in the State will need to play an increasing role in this effort. Success will require the creation of new policies in some sectors, and expanding and refining existing policies in others. We must continue working to find the right combination of policy-based "push" and incentive-based "pull" to accelerate commercial markets for clean energy and efficiency. And we have to coordinate and align public investments in ways that most effectively leverage private resources.

The Great Unifier

Climate change presents an unprecedented set of challenges for California. We are already experiencing its impacts and know that they will only increase. But it can also be a great unifier. It gives us the opportunity to focus on doing more with less; to work across programmatic, policy and political boundaries; and to figure out ways to achieve various goals more quickly and more effectively. The task is to continue building on the steps we have already taken by further integrating climate thinking and sustainability programming into the range of actions we take to grow the economy, protect the environment and public health, and plan for the future.

The strategies we pursue to cut greenhouse gas emissions from our cars, trucks, buses, trains and industries can support ongoing efforts to improve air quality up and down the State, especially in our most heavily impacted communities. Efficiency and conservation programs in the water sector needed to cut emissions will also drive critically needed efforts to enhance supply and reliability priorities. We can cut emissions from our waste stream while also increasing home-grown sources of low-carbon energy and fuels. And we can manage our natural lands and valuable agricultural resources in ways that both achieve climate objectives and enhance their long-term sustainability.

With strategic investment and coordinated policy-making, California can slash emissions from trucks and trains while at the same time building a world-class goods movement and freight-delivery system. We can modernize our rail and passenger transportation systems to move people in ways that both reduce greenhouse gases and increase mobility options and safety. We can take actions to cut emissions of potent short-lived climate pollutants that will also deliver key public health benefits. And we can align strategies that both support reduction goals and bolster our ability to deal with the impacts of climate change already underway.

The reality is that while climate change demands it, these and myriad other examples described in this Update are exactly the types of actions California must take in any case to build for our future.

Mid-Term Target

As supported by many of California's climate scientists and economists, a key step needed to build on California's framework for climate action is to establish a mid-term statewide emission reduction target. Cumulative emissions drive climate change, and a continuum of action is needed to reduce emissions not just to stated limits in 2020 or 2050, but also every year in between. The target will ensure that the State stays on course and expands upon the successes we have achieved to date so that we can achieve our long-term objective of reducing California's greenhouse gas emissions to the scientifically recognized level necessary for climate stabilization. A mid-term target, informed by climate science, will be critical in helping to frame the additional suite of policy measures, regulations, planning efforts, and investments in clean technologies that are needed to continue driving down emissions. It will also send a clear signal that California is solidifying its commitment to a low-carbon future, giving businesses the long-term certainty they need to plan for the future.

Each of the major sectors highlighted in this Update must play a role in supporting the statewide effort to continue reducing emissions. As steps are taken to develop a statewide target, sector targets will also be developed that reflect the opportunities for reductions that can be achieved through existing and new actions, policies, regulations and investments.

Sector-Specific Actions

Energy

The actions outlined in this Update support California's efforts to build a state-of-the-art energy generation, supply and distribution system that is clean, affordable and reliable. Many of the actions expand upon existing policy frameworks that have made our State a global leader in areas like energy efficiency, demand response, and renewable energy generation. Others reflect the need to incorporate new and rapidly evolving technologies like energy storage, demand response, and a smarter grid into the fabric of California's energy system.

A core element of the Update is the development of a comprehensive greenhouse gas reduction program for the State's electric and energy utilities by 2016. This approach will enable California to pull together and coordinate a range of policies, technologies, and investments needed to achieve the most cost-effective emission reductions across the sector, in line with meeting mid-term and long-term statewide targets. It also will give utilities, electricity providers and a range of other businesses the flexibility and the right incentives to pursue the most innovative strategies to cut emissions.

Transportation, Land Use, Fuels, and Infrastructure

Over the past several decades, California has pioneered a host of innovative policies in the transportation sector that have cut air pollution and greenhouse emissions. This Update builds on a set of existing policies and lays out new strategies that will continue to push down emissions and scale up clean, advanced technologies across the entire transportation sector. It calls for targeted investment in critical infrastructure projects that will be necessary to keep California on track to meet our ongoing climate objectives. And it recognizes the need to closely integrate climate planning with efforts to meet California's air quality goals.

Meeting California's long-term air quality and climate objectives will require the State to continue building on efforts underway to put more low and zero-emission vehicles on the road. These efforts also need to be expanded to include an increasing focus on cleaner medium- and heavy-duty vehicles. At the same time, we must continue working to figure out the right mix of policies and incentives for increasing reductions in the carbon content of transportation fuels. And we must invest in building the cleanest, most advanced systems and infrastructure to move people and goods in the State. Key approaches to this include high speed rail and the Sustainable Freight Initiative.

Agriculture

California's agricultural industry provides hundreds of thousands of jobs and tens of billions of dollars in economic value to the State each year. The long-term sustainability of the sector is vital to California's economic future. This Update describes a set of actions to ensure California's agricultural sector continues to thrive in the face of a changing climate and plays a key role in the State's efforts to continue reducing greenhouse emissions.

There is a range of opportunities for greenhouse gas emission reductions and sequestration in the agriculture sector. Technological advancements allow for more precise irrigation techniques, which cut energy costs and preserve valuable water resources. Strategic approaches to conservation will keep valuable agricultural lands in operation and help eliminate greenhouse gas emissions that result from conversion. And capturing methane from agriculture operations will provide climate benefits while also affording opportunities to produce bioenergy and biofuels. The coordinated effort to develop the right mix of policies and incentives described in this Update will help keep California's agriculture sector thriving into the future.

Water

Water is the lifeblood of our State and economy, and integrally connected to our food supply and energy systems. With the declaration of a drought emergency, the State needs to employ a range of approaches that will cut emissions, maximize efficiency and conservation, and enhance water quality and supply reliability, while also addressing growing climate resiliency requirements.

A greater focus on integrated policy design in the water sector is needed as California implements strategies that will support our State's longer-term climate objectives. State policy and regulatory frameworks must be developed that allow for, and incentivize, effective regional integrated planning and implementation. We need to employ pricing policies that will maximize efficiency and conservation efforts in the water sector, and put in place mandatory conservation measures to reduce greenhouse gas emissions and maintain water supply reliability during drought periods.

Waste

California's goal of reaching 75 percent recycling and composting by 2020 provides an opportunity to achieve substantial GHG emission reductions across the waste sector, while providing other significant economic and environmental co-benefits. Much of what is traditionally considered "waste" can be a resource for other uses. California must take advantage of waste materials to generate energy to power our homes and cars, and to improve our working lands.

Compostable organics represent over a third of California's disposed waste, and are the primary source of fugitive methane emissions at landfills. A new organics management approach for California that will divert this material to minimize emissions at landfills and provide feedstock for critically needed alternatives to agricultural amendments and for low carbon fuel manufacturing.

Achieving the 75 percent waste diversion goal will require substantial expansion of the collection, recycling, and manufacturing industries within California. This Update sets forth a series of actions to support this industrial growth and calls on California to manage its waste at home in ways that will support greenhouse gas emission reductions, environmental co-benefits, and job growth.

Natural and Working Lands

Three-quarters of California's landmass comprises biologically diverse landscapes such as forests, woodlands, shrublands, grasslands and wetlands. These natural and working lands provide a multitude of economic and environmental benefits, and must play an increasingly important role in California's efforts to prepare for and adapt to the impacts of climate change. Natural and working lands must also play a key role to help achieve California's long-term climate objectives. We have to start investing now in strategies that ensure these lands are managed in ways that maximize their carbon benefits while also ensuring landscape resilience; protecting and enhancing the State's water supplies; safeguarding the State's wildlife, fish, and plants; and promoting sustainable rural communities.

This Update describes a series of policies, actions, and strategic investments to enhance, protect, and conserve California's natural and working lands in ways that will provide important climate benefits as well as a more resilient California that is better prepared for climate risks such as more frequent and severe wildfires, varying and unpredictable water availability, and stressors on species and natural communities. A key element of this approach is the development of a "Forest Carbon Plan" by 2016 that will set mid and long-term greenhouse gas reduction planning targets, and identify funding and investment needs.

Short-Lived Climate Pollutants

Over the past several decades, California's actions to improve air quality and protect public health have resulted in significant reductions in potent short-lived climate pollutants, which include black carbon, methane, and hydrofluorocarbons. These pollutants remain in the atmosphere for shorter periods of time and have much larger global warming potentials compared to CO_2.

While we must continue taking steps to rapidly reduce CO_2 emissions, additional efforts to cut emissions of short-lived climate pollutants can yield immediate climate benefits. In addition, fast and sustainable actions to reduce these emissions can help to achieve other benefits though avoided impacts on agriculture, water availability, ecosystems, and human health. The reduction of methane would reduce background tropospheric ozone concentrations, which would help with progress towards healthy air quality and avoid crop yield losses and forest damage due to the direct action of ozone on plant growth. Black carbon impacts cloud formation and precipitation, and black carbon deposits on glaciers and snowpack accelerate melting. Reducing black carbon and methane emissions will help reduce the risk for premature deaths, air pollution-related hospitalizations, and associated medical expenses each year.

California is committed to continuing to reduce emissions of short-lived climate pollutants, particularly where efforts will result in air quality and public health co-benefits. ARB will develop a short-lived climate pollutant strategy by 2015 that will include an inventory of sources and emissions, the identification of additional research needs, and a plan for developing necessary control measures.

Green Buildings

Buildings in California represent a significant source of greenhouse gas emissions. Over the past five years, California has solidified its commitment to green building; leading the way with State buildings, improving building standards, continuing to raise the bar with voluntary programs at the local level, and greening existing buildings. We must continue to build on this approach by ensuring successful implementation of current initiatives and expanding the long term focus towards zero-carbon buildings.

This Update describes a set of actions to continue cutting emissions from California's building sector including the development of a comprehensive greenhouse gas emission reduction program for new construction, existing building retrofits, and operation and maintenance. This Update describes a set of actions to continue cutting emissions from California's building sector including the development of a comprehensive greenhouse gas emission reduction program for new construction, existing building retrofits, and operation and maintenance of certified green buildings.

Courage, Creativity, and Boldness

Climate change has presented us with unprecedented challenges—challenges that cannot be met with traditional ways of thinking or conventional solutions. As Governor Brown has recognized, meeting these challenges will require "courage, creativity, and boldness."

It will require California to continue to lead the world in pioneering effective strategies toward a cleaner, more sustainable economy. It will require us to continue sharing our successful approaches to climate policy with others, including continuing to partner and collaborate with other state, national, and global leaders as we work toward common goals. And it will require further engaging California's citizens, businesses, and its most creative minds to continue building a state that provides low carbon, high-quality lifestyles.

As we take these steps, we understand that we don't have all of the answers today. But, we are on the right path. We have a framework for action in place that is driving down emissions, spurring innovation across a range of clean and advanced technology sectors, improving the air Californians breathe, and creating more livable communities. By building on this framework with the set of actions outlined in this Update, we can do our part to meet the challenge of global climate change, and in the process, continue to build the clean, sustainable future that all Californians deserve.

I. Introduction: Building on the Framework

This Scoping Plan Update builds upon the successful framework established by the initial Scoping Plan by outlining priorities and recommendations for the State to achieve its long-term climate objectives. The unified approach in this Update describes actions for California to undertake to ensure it continues on a path toward a cleaner, more sustainable and prosperous future. This approach is designed to ensure the State is able to meet its long-term climate objectives that will achieve continual emission reductions in the most cost-effective ways, while simultaneously supporting a range of economic, environmental, water supply, energy security, environmental justice, and public health priorities.

Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006 (AB 32, Statutes of 2006, Chapter 488) declares that global warming poses a serious threat to the economic well-being, public health, natural resources, and environment of California and charges the California Air Resources Board (ARB) with "monitoring and regulating sources of emissions of greenhouse gases that cause global warming in order to reduce emissions of greenhouse gases" (Health and Safety Code section 38510). AB 32 provided initial direction on creating a comprehensive multi-year program to limit California's greenhouse gas (GHG) emissions at 1990 levels by 2020 and initiate the transformations required to achieve the State's long-range climate objectives. One specific requirement is to prepare a "scoping plan" for achieving the maximum technologically feasible and cost-effective GHG emission reductions by 2020 (Health and Safety Code section 38561(a)). ARB is required to update the plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions at least once every five years (Health and Safety Code section 38561(h)). The language of AB 32 is included in Appendix A.

The initial Scoping Plan was approved in 2008, as required by AB 32, and reapproved in 2011. The initial Scoping Plan contained a mix of recommended strategies that combined direct regulations, market-based approaches, voluntary measures, policies, and other emission reduction programs calculated to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the State's long-range climate objectives. The passage of the Global Warming Solutions Act, and its ongoing implementation, has put California on a path to continually reduce GHG emissions by adopting and implementing regulations and other programs to reduce emissions from cars, trucks, electricity production, fuels, and other sources.

While the path to limit emissions to 1990 levels by 2020 is transformative in its own right, reducing emissions to meet the State's long-range objectives will require continued progress toward efficient clean energy in every sector of the economy and new opportunities to value and integrate agricultural, natural, and working lands into a comprehensive climate policy framework. The State's 2050 objective of reducing emissions to 80 percent below 1990 levels, as reflected in Executive Order S-3-05 and Governor Brown's Executive Order B-16-2012 (which is specific to the transportation sector), is consistent with an Intergovernmental Panel on Climate Change (IPCC)[1] analysis of the emissions trajectory that would stabilize atmospheric GHG concentrations at 450 parts per million carbon dioxide equivalent (CO_2e) and reduce the likelihood of catastrophic climate change.

1 The IPCC is the leading international body for the scientific assessment of climate change established in 1988 under the auspices of the United Nations.

Continuing progress to the 2050 objective requires California to maintain and build upon its existing programs, scale up deployment of clean technologies, and provide more low-carbon options to accelerate GHG emission reductions, especially after 2020.

A. AB 32: California's Global Warming Solutions Act

Under AB 32, California has established a unique, broad program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective GHG emission reductions. Since 2006, ARB has carried out the following specific tasks required by AB 32:

- **Determine the 1990 GHG emission level to serve as the 2020 emission limit:** In December 2007, the Board approved the 2020 limit of 427 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) GHG emissions.
- **Adopt a regulation requiring GHG emission reporting:** In December 2007, the Board approved a regulation requiring the largest industrial sources in California to report and verify their GHG emissions.
- **Identify and adopt regulations that could be enforceable by January 1, 2010:** In 2007, the Board identified nine discrete early action measures, which have all been adopted.
- **Develop a scoping plan for achieving the maximum technologically feasible and cost-effective GHG emission reductions by 2020 and update the report every five years to continue to consider future achievement of maximum technologically feasible and cost-effective GHG emission reductions:** The first Scoping Plan was approved by the Board in 2008 and reapproved in 2011. This report is the first update to the Scoping Plan.
- **Maintain and continue GHG emission reductions beyond 2020:** This first update presents the priorities and recommendations for achieving the State's longer-term emission reduction objectives.

Meeting the State's climate objectives requires a coordinated and cohesive statewide strategy based on informed decisions that draw upon research, technology, infrastructure, the State's policy priorities, and potential co-benefits. Planning must continue to further align the State's longer-term GHG reduction strategies with other State policy priorities, including those related to economic development, water, waste, natural resources, agriculture, clean energy, transportation, and land use.

B. Building on California's Environmental Legacy

Just as California has done time and again over the past 40 years, the State is decoupling economic growth from pollution and waste. Continually, California has implemented rational, well-supported policies that have—among many other accomplishments—dramatically cut pollution from new cars, made its new buildings and appliances the most efficient in the country, phased out lead from gasoline and created the cleanest-burning transportation fuels in the world, phased out dirty coal- and oil-burning power plants, and brought entire new industries to life and clean technologies to market.

This progress did not come without battles, debates, or skepticism. But in each case, armed with strong scientific backing, California persevered, prevailed, and ultimately provided a case study to the world that proved a conventional wisdom false: Economic growth is not inherently linked to pollution, increasing energy consumption, or consumption of fossil resources.

California has successfully pioneered dozens of new energy and environmental policies that repeatedly demonstrate that economic growth does not have to be one of a set of trade-off considerations or come at a cost to future generations.

California's policy successes derive from the fact that, when faced with the certainty of reasonable policy, businesses innovate and successfully cut pollution with consumer-oriented solutions that drive their markets forward and continue economic growth. The result is fewer emissions, improved public and environmental health, and better products that allow industries and businesses to grow and flourish.

Many others throughout the world look to adopt or mimic California's leading policies and build similar markets for clean technologies. California is regarded as a global leader for developing successful policy solutions to deal with pressing environmental problems—whether it is other states or the federal government adopting California vehicle and fuel standards; subnational governments in Canada and Mexico looking to do the same; or delegations from countries in Europe, Asia, and Australia visiting to learn how we monitor and control air pollution, improve vehicle and building efficiency, develop smarter communities, and build markets for clean energy and fuels.

Through the Global Warming Solutions Act, California is continuing to lead with effective policies to address global climate change. Once again, we are proving conventional wisdom wrong, and showing that we can dramatically reduce emissions of GHGs while growing our economy.

Since the initial Scoping Plan was released, California has put in place a number of measures that have already led to significant emission reductions, and a transformation to a strong, stable low-carbon economy in California is under way. We are on the right path. Our actions are reducing GHG emissions, spurring innovation across a range of clean and advanced technology sectors, improving the air Californians breathe, and creating more livable communities. All the while, our economy continues to grow, and we continue to add jobs more quickly than the rest of the country. By continuing down this path, California will do its part to meet the challenge of global climate change, and in the process, continue to build the clean, sustainable future all Californians deserve.

SUCCESS STORY

Propel Fuels Moves to California

Propel Fuels is a renewable biofuels company which relocated to California specifically because of the economic opportunities created by AB 32's Low Carbon Fuel Standard (LCFS). The LCFS encourages investment in a wide variety of alternative transportation fuels, and Propel specializes in providing E85 (ethanol) flex fuel and other fuels. Part of Propel's unique business model involves placing its fuel pumps at already-existing gas stations. The company supplies individual motorists, truck operators and commercial vehicle fleets. Propel had $4.5 million in revenue in 2012, and was 42nd on Forbes Magazine's list of "Most Promising Companies".

However, we know we need to do more, and we need to move faster. The world is watching, just as it always has, and is banking on our success to spur broader action. It is critical that California continues to lead and implement successful policies that can expand beyond our borders.

C. Initial Scoping Plan

With the development of the initial Scoping Plan, California became the first state in the nation with a comprehensive set of GHG emission reduction strategies involving every sector of the economy. The measures and policies in the Scoping Plan set California on a trajectory toward a clean-energy future. The recommended reduction measures drive innovation, improve the environment, enhance public health, and support the growth of clean energy technologies and businesses. By moving first, California is well-positioned to lead in the race to develop the clean technology products, patents, and projects the global market demands and needs to address climate change.

The comprehensive approach in the initial Scoping Plan addressed key criteria, including technological feasibility, cost-effectiveness, overall societal benefits, and impacts on specific sectors such as small business and disproportionately impacted communities. The thorough planning process underlying the initial Scoping Plan and this Update helps to ensure that California meets its GHG reduction targets in a way that promotes and rewards innovation, helps to foster economic growth, and delivers improvements to the environment and public health, including in the most affected communities.

Key elements of the initial Scoping Plan included the following:

- Expand and strengthen energy efficiency programs, including building and appliance standards.
- Increase electricity generation from renewable resources to at least 33 percent of the statewide electricity mix by 2020.
- Establish targets for passenger vehicle-related GHG emissions for regions throughout California and pursue policies and incentives to achieve those targets. Included with this strategy is support for the development and implementation of a high speed rail system to expand mobility choices and reduce GHG emissions.
- Adopt and implement measures pursuant to existing State laws and policies, including California's clean car standards and the Low Carbon Fuel Standard.
- Develop a cap-and-trade program to ensure the target is met, while providing flexibility to California businesses to reduce emissions at low cost.

The initial Scoping Plan identified specific GHG emission reduction measures that would assist the State in meeting the 2020 limit. A discussion of the status of all of the Scoping Plan measures is included in Appendix B.

D. Purpose of Update

This Update identifies the next steps for California's leadership on climate change. While California continues on its path to meet the near-term 2020 greenhouse gas limit, it must also set a clear path toward long-term, deep GHG emission reductions. This report highlights California's success to date in reducing its GHG emissions and lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050.

This first Update to the initial AB 32 Scoping Plan (Update) describes progress made to meet the near-term objectives of AB 32 and defines California's climate change priorities and activities

for the next several years. It also frames activities and issues facing the State as it develops an integrated framework for achieving both air quality and climate goals in California beyond 2020. Specifically, this Update covers a range of topics:

- An update of the latest scientific findings related to climate change and its impacts, including short-lived climate pollutants.
- A review of progress-to-date, including an update of Scoping Plan measures and other state, federal, and local efforts to reduce GHG emissions in California.
- Potential technologically feasible and cost-effective actions to further reduce GHG emissions by 2020.
- Recommendations for establishing a mid-term emissions limit that aligns with the State's long-term goal of an emissions limit 80 percent below 1990 levels by 2050.
- Sector-specific discussions covering issues, technologies, needs, and ongoing State activities to significantly reduce emissions throughout California's economy through 2050.
- Priorities and recommendations for investment to support market and technology development and necessary infrastructure in key areas.
- A discussion of the ongoing work and continuing need for improved methods and tools to assess economic, public health, and environmental justice impacts.

Progressing toward California's long-term climate goals will require that GHG reduction rates be significantly accelerated. Emissions from 2020 to 2050 will have to decline at more than twice the rate of that which is needed to reach the 2020 statewide emissions limit.

In addition to our climate objectives, California also must meet federal clean air standards. Emissions of criteria air pollutants, including ozone precursors (primarily oxides of nitrogen, or NO_x) and particulate matter, must be reduced by, a currently estimated, 90 percent by 2032 to comply with federal air quality standards. The scope and scale of emission reductions necessary to improve air quality is similar to that needed to meet long-term climate targets. Achieving both objectives will align programs and investments to leverage limited resources for maximum benefit.

Accelerating progress on this scale will require both continuation of existing policies and implementation of new ones to help significantly scale market adoption of the cleanest, most-efficient technologies. It will require a new approach to energy production and utilization, and strong mid-term targets to measure and guide the State's progress. This document outlines the challenges we face to achieve this vision, which will be the subject of ongoing climate and investment planning efforts in California in the coming years.

E. Process for Developing the Update

This Update was developed with input from State and local agencies, community and environmental justice organizations, and other interested stakeholders in an open and public process.

ARB held an initial public workshop in June 2013 to discuss preliminary concepts for this Update. As part of the workshop, ARB and other State agency representatives provided a vision for each focus area for 2050 and challenges that must be addressed to meet that vision. ARB and other State agencies also co-hosted public regional workshops with local air districts and metropolitan planning organizations throughout the State (Bay Area, South Coast, and San Joaquin Valley). The workshops were convened to discuss preliminary concepts for this Update (similar to the initial workshop) and to provide a local/regional perspective on both progress to date and regional priorities for California's climate program.

A discussion draft of the Update was released for public comment on October 1, 2013. The discussion draft was presented at a public meeting and a Board hearing later that month to further solicit public input. After consideration of comments received, staff released a draft Proposed Update on February 10, 2014, and presented it to the Board for discussion at its February 20, 2014, meeting. At that meeting, the Board directed staff to make specific changes to the draft report. A draft environmental analysis (EA) of the Proposed Update was released for a 45-day public comment period on March 14, 2014. After considering public comments received and Board direction, ARB staff released a final First Update, along with the summary of comments received on the draft EA and ARB's responses to those comments, and the final EA on May 15, 2014.

Under the guidance of the Climate Action Team, ARB and other State agencies collaborated during the development of the Update to identify and describe a long-term vision and near-term activities to put California on the path to its 2050 emission reductions goal. To help guide in this effort, ARB identified six key focus areas comprising major components of the State's economy to evaluate and describe the larger transformative actions that will be needed to meet the State's more expansive emission reduction needs by 2050.

Climate Action Team

California Environmental Protection Agency

Governor's Office of Planning and Research

California Air Resources Board

Business, Consumer Services, and Housing Agency

Government Operations Agency

California Natural Resources Agency

California Department of Public Health

Office of Emergency Services

California Transportation Agency

California Energy Commission

California Public Utilities Commission

Department of Food and Agriculture

Department of Forestry and Fire Protection

Department of Fish and Wildlife

Department of Transportation

Department of Water Resources

Department of Resources, Recycling and Recovery

State Water Resources Control Board

The focus areas include:

- Energy
- Transportation (Vehicles/Equipment, Sustainable Communities, Housing, Fuels, and Infrastructure)
- Agriculture
- Water
- Waste Management
- Natural and Working Lands

State agency focus area workgroups were created in 2013 to conduct these evaluations. Various State agencies took lead roles. For example, the California Energy Commission (CEC) took the lead for the energy sector and ARB took the lead for transportation. Each workgroup developed a working paper which formed the foundation upon which the agencies, with stakeholder input, identified recommendations for policy or program priorities for the next five years. Recommended action items for meeting the longer-term GHG emission reduction goals are presented in Chapter IV. The working papers are included in Appendix C.

AB 32 requires ARB to convene an Environmental Justice Advisory Committee (Committee) to advise it in developing the Scoping Plan and any other pertinent matters in implementing AB 32 (Health and Safety Code section 38591). The Board convened the Committee in 2007 to advise it

on the development of the initial Scoping Plan. The Board reconvened the Committee to advise it on the development of this Update. The Committee met four times from June 2013 to April 2014 to discuss the Update. The Committee focused their discussions on each Scoping Plan sector and developed comprehensive recommendations that ARB considered in drafting this Update. The Committee's "Final Recommendations on the Proposed AB 32 Scoping Plan" provided recommendations for each Scoping Plan sector and overarching environmental justice policy. The final recommendations included the need for monitoring and assessing potential impacts of the State's climate programs; a call for a 2030 target of, at a minimum, 40 percent reduction from 1990 levels and a 2040 target of, at a minimum, 60 percent reduction from 1990 levels; a call for California to reduce its energy use and transition to 100 percent renewable energy; financial support for transportation in disadvantaged communities; and amendments to the Cap-and-Trade Regulation that would exclude direct allocation and offset credits. The Committee's final recommendations are included in Appendix E.

ARB also convened a panel of economic experts to serve as advisors during the development of this Update and provide recommendations for evaluating the economic impacts associated with AB 32. The advisors were invited to participate in teleconferences, review draft documents, and provide feedback to ensure that the economic impacts of programs implemented under AB 32 are analyzed with the best available data and methods. ARB consulted with the advisors on the best means of assessing economic impacts to date, as well as estimating future impacts of existing or new emission reduction strategies. ARB will continue to seek expert economic advice in the evaluation of the impacts of AB 32 and the Scoping Plan on California's economy as the program continues to be implemented.

In addition, a group of distinguished scientists with expertise in observed climate change in California, projection of future climate change impacts, and short-lived climate pollutants, provided input on the latest climate science discussion in the Update.

ARB also held numerous meetings and conference calls with individuals and stakeholder groups such as industry associations, environmental groups, tribes, and small businesses on specific issues or recommendations to address in this Update.

II. Latest Understanding of Climate Science

The latest climate science further underscores the urgent need to accelerate GHG emission reductions to avoid the most severe impacts of climate change. Focusing on additional measures to reduce emissions of climate-warming pollutants with shorter atmospheric lifetimes (known as short-lived climate pollutants) could provide immediate air quality and public health benefits while helping to slow the rate of human-caused climate change.

Scientific Expert Reviewers

Dr. Daniel Cayan	*Scripps Institution of Oceanography, UC San Diego and U.S. Geological Survey*
Dr. Michael Prather	*UC Irvine*
Dr. V. Ramanathan	*Scripps Institution of Oceanography, UC San Diego*

Climate scientists agree that global warming trends and other shifts in the climate system observed over the past century are almost certainly attributed to human activities and are proceeding at a rate that is unprecedented when compared with climate change that human society has lived through to date. Climate change is measured by examining recent shifts in the features (statistics, including extremes) that are associated with average weather, such as temperature, wind patterns, and precipitation, plus long-term trends in the great ice sheets, Arctic sea ice, and mean sea level. Since the development of the Scoping Plan, even stronger scientific evidence continues to mount that document that the climate is changing and that its impacts are widespread and occurring now. This evidence includes rising temperatures, shifting snow and rainfall patterns, and increased incidence of extreme weather events. To ensure that this new evidence on the impacts of climate change is accurately summarized, this chapter was reviewed by a group of distinguished scientists with expertise in observed climate change in California, projection of future climate change impacts, and short-lived climate pollutants.

The recently released Summary for Policymakers (SPM)[2] portion of Working Group I (WGI), the first in a series of reports comprising the IPCC Fifth Assessment Report (AR5), affirms that the planet is warming, that human beings are "extremely likely" (indicating 95 percent certainty) to be the primary cause, and that some of the impacts of greatest concern, such as glacial melting, are accelerating at a faster pace than documented in previous assessments.

This understanding of the climate system in AR5 results from combining observations, theoretical studies of feedback processes, and model simulations. Compared to earlier reports, more detailed observations and improved climate models now enable the attribution of detected changes to human influences in more climate system components and at higher spatial resolution. The consistency of observed and modeled changes across the climate system, including regional temperatures, the water cycle, the global energy budget, sea ice, and oceans (including ocean acidification) point to global climate change resulting primarily from human-caused increases in GHG concentrations.

2 *www.climate2013.org/images/report/WG1AR5_SPM_FINAL.pdf*

The IPCC report notes a continued rate of global warming along with the increasing radiative forcing driven by greenhouse gases. The rate of global surface air temperature warming over the past 15 years—about 0.05°C per decade—has been slower than the average rate since 1951, but the last decade is still the warmest observed, and each of the last three decades has been successively warmer than any preceding decade since 1850. The key findings include:

Increased certainty on humans' role: Scientists are now more certain than ever that observed warming can be attributed primarily to human activities such as exploitation of fossil fuels and deforestation. The report underscores the growing body of scientific evidence confirming the serious detrimental impacts of increasing atmospheric GHG burden.

Accelerating impacts of climate change: Several indicators of climate change are advancing faster than found in previous assessments.

- ***Ice Loss:*** Arctic summer sea ice retreat was unprecedented and sea surface temperatures were anomalously high in comparison to at least the last 1,450 years. The melting of ice sheets over the past decade is happening several times faster than it was in the 1990s. Glacial melt has accelerated as well. There is high confidence that current glacier extents are out of balance with current climatic conditions, indicating that glaciers, ice sheets, and sea ice will continue to shrink in the future even without further temperature increases.
- ***Sea-Level Rise:*** The rate of sea level rise since the mid-nineteenth century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 7.48 inches (19 centimeters). Global mean sea level will continue to rise during the twenty-first century, and the rate of sea level rise will exceed that observed during 1971 to 2010 due to increased ocean warming (leading to the thermal expansion of the water) and increased loss of mass from glaciers and ice sheets.
- ***Ocean Acidification:*** Due to excess carbon dioxide in the atmosphere, the pH of seawater has decreased. This increased acidity poses risks to ocean ecosystems—the development of many shellfish, plankton, and other forms of ocean life—as well as to people who depend on oceans for their livelihood.
- ***Heat Waves:*** It is likely that human influence has already contributed to the observed changes in the frequency and intensity of daily temperature extremes on the global scale since the mid-twentieth century, and has significantly increased the probability of occurrence of heat waves in some locations.
- ***Air Quality:*** There is high confidence that warming is decreasing baseline surface ozone globally, but higher methane emissions are counteracting and overriding this impact. There is medium confidence that locally higher surface temperatures in polluted regions will increase peak levels of ozone and particulate matter 2.5 microns or smaller ($PM_{2.5}$), but a no confidence level is attached to the overall impact of climate change on $PM_{2.5}$.

As documented in the AR5 report, accumulating observations underscore the fact that the important parts of the climate system have a long memory. Continued emissions of GHG will cause further warming and changes in all components of the climate system. Cumulative emissions of CO_2 largely determine global mean surface warming by the late twenty-first century and beyond. Most aspects of climate change will persist for many centuries, even if CO_2 emissions are radically reduced. This represents a substantial multi-century climate change commitment created by past, present, and future CO_2 emissions. Limiting climate change will require substantial and sustained reductions of GHG emissions.

California is a large state that is particularly vulnerable to the effects of climate change. The State is facing a range of impacts, including increases in extreme heat, wildfires, drought, extreme storms, coastal flooding, and erosion, and reductions in the Sierra Nevada springtime snowpack. Climate change also threatens to affect water availability. Climate and hydrological models indicate that warming will likely diminish river discharge in the Colorado Basin as global

climate change advances over the next several decades. A new study[3] suggests that both the California drought and the polar vortex, two persistent extreme weather outcomes observed this past winter season, may be linked to the same underlying cause: climate change as a result of warming from the accumulation of GHGs. California's efforts to reduce GHG emissions and avoid the worst impacts of climate change must occur in parallel with planning for and adaptation to climate change that is already occurring, as well the climate change that is already in the pipeline out to 2050 and beyond, immaterial of future mitigation.

The climate effects of emissions from different climate-forcing pollutants vary in terms of both magnitude and duration. There is growing recognition, both from a scientific and regulatory perspective, that mitigation of short-lived climate pollutants would lead to immediate reductions in the rate of climate change. Although there is no precise definition of short-lived climate pollutants, these include pollutants such as black carbon, tropospheric ozone, methane, and hydrofluorocarbons, all of which will decay in the atmosphere on the order of days to decades. These timescales are much shorter than centennial time scale for CO_2, where about 40 percent of currently emitted CO_2 will remain in the atmosphere by 2100 and affect climate for centuries beyond. Black carbon (as a component of $PM_{2.5}$) and ozone are air pollutants with substantial health effects, and reducing their emissions can offer significant improvements in air quality and public health. In addition to the short-lived, local ozone precursors (NO_X, VOCs), methane is a global source of tropospheric ozone.

A. Continuing Evidence of Climate Change in California in Agreement with Projected Changes

Important climate change impacts are already being detected in California. California's Office of Environmental Health Hazard Assessment recently published the report, *Indicators of Climate Change in California*, which tracks trends in GHG levels, changes in the state's climate, and the impacts of climate change on California's environment and people.

Climate change is already affecting California's infrastructure, natural resources, and communities, with even larger impacts projected in the future.

Heat: More extreme hot days, fewer cold nights, and shifts in the water and growing cycles are already being observed in California. Sheridan and Kalkstein[4] project a marked increase in the number and duration of heat waves over the remainder of this century. For example, historically, in the populated areas of California, 14-day heat waves have occurred no more than once per year, with most locations not having any. By 2050, the frequency of 14-day heat waves is projected to increase up to tenfold. These increases will require a major effort to avoid heat-related death and illness, and will have a substantial effect on water and energy usage. Increases in ambient air temperature and the frequency of extreme heat events will reduce the efficiency of conventional power plants burning fossil fuels, and increase peak electricity demand for major cities for air conditioning.

Air Quality: Many Californians still experience air pollution levels that exceed health-based air quality standards. Climate warming would slow progress toward attainment of ozone air quality standards and increase pollution control costs by increasing the potential for high ozone days. A study[5] found that California could experience as many as six to thirty more days with ozone concentrations that exceed federal clean-air standards, depending on the extent of increased temperatures. In the southern California region, projected changes in ozone concentrations due

3 Wang, S.-Y., L. Hipps, R. R. Gillies, and J.-H. Yoon (2014), Probable causes of the abnormal ridge accompanying the 2013–2014 California drought: ENSO precursor and anthropogenic warming footprint, Geophys. Res. Lett., 41, doi:10.1002/2014GL059748. *http://onlinelibrary.wiley.com/doi/10.1002/2014GL059748/pdf*

4 Sheridan, S., and L. Kalkstein. 2011. A Spatial Synoptic Classification Approach to Projected Heat Vulnerability in California under Future Climate Change Scenarios. ARB contract #07-304. *www.arb.ca.gov/research/apr/past/07-304.pdf.*

5 Kleeman, M. J., S.-H. Chen, and R. A. Harley. 2010. Climate change impact on air quality in California: Report to the California Air Resources Board. *www.arb.ca.gov/research/apr/past/04-349.pdf*.

to climate change in the year 2050 could increase by 9 to 18 parts per billion. These studies reflect the increased efficiency of ozone production in a warmer climate, the potential for increased biogenic VOC emissions driven by higher temperatures, and increased tropospheric ozone levels due to higher methane emissions.

Wildfire Risks: Forest and wildland fires are becoming more frequent and intense, in part because dry seasons have started earlier and ended later. Since 1950, annual acreage burned in wildfires has been increasing in California. The three largest fire years occurred in the last ten years.[6] A recent study[7] estimated future wildfire activity over the western United States during the mid-twenty-first century (2046–2065). The results show that the fire season is expected to lengthen by 23 days in the warmer and drier climate at mid-century. Besides the damage to natural and managed systems, it was indicated that wildfire emissions would increase levels of summertime short-lived climate and air pollutants such as black carbon and $PM_{2.5}$.

Sea Level Rise: Sea levels have risen by six inches or more along much of the California coast over the last century, increasing erosion and pressure on the State's infrastructure, water supplies, and natural resources.[8] A 2012 report by the California Climate Change Center presented the state of the climate affairs in California, and discussed their impacts on the State's natural resources.[9] The report noted that, in addition to sea level rise and associated seawater intrusions, possible flooding from increased storm runoff from mountain catchments, and storm surges threaten freshwater supplies in the Sacramento–San Joaquin River Delta. Flooding also threatens existing levees and many low-lying areas in the Delta and Central Valley.[10] Critical infrastructure such as roads and highways, ports, harbors, airports, wastewater treatment facilities, and power plants are located in low-lying coastal areas. Coastal habitats such as beaches, dunes, cliffs, and bluffs could be lost to erosion, while groundwater aquifers could be impacted more widely than today by seawater intrusion and wetlands and bays could face permanent inundation.[11]

Sea level rise and increased storm frequency and intensity could also affect the operations of coastal power plants and coastal petroleum, natural gas, and transportation-related fuels infrastructure.

Agriculture: Agriculture is especially vulnerable to altered temperature, changing rainfall patterns, and new pest problems. Several scientific studies have been conducted that document the adverse impact that climate change is likely to have on crops and food supply. California agriculture is a nearly $40 billion dollar industry, and it generates at least $100 billion in related economic activity.[12]

Water Supply: Increased temperatures with decreased winter snowfall, as well as earlier snowmelt and greater rainwater runoff occurring earlier in the year, threaten the State's major water supply—the Sierra Nevada snowpack and timed downstream reservoir releases. Reduced snowpack puts greater pressure on the State's other major storage components, including water stored in reservoirs and groundwater aquifers. Lowering groundwater levels in turn create a greater energy demand to pump water from deeper wells and further reduce groundwater

6 Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. Indicators of Climate Change in California. August 2013. *www.oehha.ca.gov/multimedia/epic/2013EnvIndicatorReport.html*.

7 Yue, Xu et al. 2013. "Ensemble projections of wildfire activity and carbonaceous aerosol concentrations over the western United States in the mid-21st century." Atmospheric Environment 77: 767-780.

8 National Research Council Report. 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. National Academies Press. *www.nap.edu/catalog.php?record_id=13389*.

9 California Climate Change Center. 2012. Our Changing Climate 2012, Vulnerability & Adaptation to the Increasing Risks from Climate Change in California. California Climate Change Center. *www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf*.

10 Knowles, N. 2010. "Potential inundation due to rising sea levels in the San Francisco Bay region." San Francisco Estuary and Watershed Science 8:1.

11 Cayan, D., M. Tyree, and S. Iacobellis. 2012. Climate Change Scenarios for the San Francisco Region. California Energy Commission. Publication number: CEC-500-2012-042.

12 Jackson, L. E., et al. 2011. "Case study on potential agricultural responses to climate change in a California landscape." Climatic Change 109 (Suppl 1): S407–S427.

contribution to rivers and streams exacerbating other impacts. Reduced Sierra Nevada snowpack and diminished runoff and water flows in late spring and summer will adversely affect hydroelectric generation and operation of the California State Water Project.[13]

As California continues to reduce GHG emissions, it is also taking steps to prepare for the impacts of climate change. In 2009, the California Resources Agency developed the first Climate Change Adaptation Strategy for California in response to Executive Order S-13-2008. The Agency released a draft of California's climate adaptation strategy in December 2013.[14] The update summarizes current science on potential climate change impacts in California and outlines possible solutions that can be implemented within and across State and local agencies.

To effectively address the challenges that a changing climate will bring, policies to reduce emissions and prepare for climate impacts should be coordinated and complementary. In fact, some of the same strategies provide both mitigation and adaptation benefits. For example, better forest management reduces the incidence of catastrophic wildfire, which reduces emissions of GHGs and also increases the carbon sequestration capacity of the forests.

B. Achieving Climate Stabilization

Scientific research indicates that an increase in the global average temperature of 2°C (3.6°F) above pre-industrial levels, which is only 1.1°C (2.0°F) above present levels, poses severe risks to natural systems and human health and well-being. Considering knowledge from the paleo-climate record with changes currently observed in the Greenland and Antarctic ice sheets, we can expect substantial sea level rise, 0.4 to 0.8 meters, with upper end uncertainties approaching one meter above present day during the 21st Century and continued substantial increase after 2100 even with stringent mitigation of emissions to achieve 2°C stabilization. Increased climate extremes, already apparent at present day climate warming (~0.9°C), will no doubt be more severe. To have a good chance (not a guarantee) of avoiding temperatures above those levels, studies focused on a goal of stabilizing the concentration of heat-trapping gases in the atmosphere at or below the 450 parts per million (ppm) CO_2-equivalent (CO_2e, a metric that combines the climate impact of all well-mixed GHGs, such as methane and nitrous oxide, in terms of CO_2).

The CO_2e target is a somewhat approximate threshold, and the exact level of CO_2e is not precisely known because the sensitivity of the climate system to GHGs has uncertainty. Different models show slightly different outcomes within this range. An example of a pre-IPCC assessment study (Meinshausen et al. 2009)[15] which has synthesized many studies on climate sensitivities, concluded that we would need to stabilize at about 400 ppm CO_2e in order to likely avoid exceeding the 2°C threshold (even at that stabilization target, there is still about a 20 percent chance of exceeding the temperature target). Further, a recent paper by an international team of scientists (Hansen et al. 2013)[16] asserts that the widely accepted target of limiting human-made global climate warming to 2°C above preindustrial levels is likely too high and may subject future generations and nature to irreparable harm. Recognizing this fact, the international community agreed in meetings in Cancun in 2012 to review, by 2015, progress to the 2°C target and consider whether it should be strengthened to a 1.5°C threshold.

What is important to recognize in these studies of warming thresholds is the critical importance of non-CO_2 gases, particularly the short-lived climate pollutants. For example, to avoid 2°C warming at a 66 percent confidence level, total carbon emissions (as CO_2e) must be kept to

13 California Energy Commission. 2009. Potential Impacts of Climate Change on California's Energy Infrastructure and Identification of Adaptation Measures. January. CEC-150-2009-001.

14 Safeguarding California: Reducing Public Risk Plan, public draft available at *http://resources.ca.gov/climate_adaptation/docs/Safeguarding_California_Public_Draft_Dec-10.pdf*.

15 Meinshausen, M., N. Meinshausen, W. Hare, S. C. B. Raper, K. Frieler, R. Knutti, D. J. Frame, and M. Allen. 2009. "Greenhouse-gas emission targets for limiting global warming to 2 °C." Nature 458:1158 1162.

16 Hansen, J., P. Kharecha, M. Sato, V. Masson-Delmotte, F. Ackerman, et al. 2013. "Assessing 'Dangerous Climate Change': Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature." PLoS ONE 8(12): e81648. doi:10.1371/journal.pone.0081648.

1000 GtC. Considering that we have already emitted about 500 GtC, which leaves 500 GtC to be divided up among nations. If the non-CO_2 gases are included then the total CO_2e emissions are at 790 GtC, leaving only 210 GtC to be emitted. Thus, there is a compelling case to reduce the short-lived climate pollutants.

In early May 2013, the Mauna Loa monitoring station, which has been shown to provide excellent measurements of CO_2 throughout the global atmosphere, recorded atmospheric CO_2 of 400 ppm,[17] substantially higher than the 316 ppm recorded when the station made its first measurements in 1958. The monitoring station offers the longest-running record of atmospheric CO_2 measured directly from the air. This recent reading will take a few years to become the international average; however, reaching 400 ppm at Mauna Loa is significant and has surpassed a worrisome milestone.

Although stabilizing atmospheric GHG concentration below 450 ppm CO_2e is important, it does not mean that once that level is reached, temperatures will immediately level off. Because of time lags inherent in the Earth's climate, the initial warming that occurs in response to a given increase in the concentration of CO_2 ("transient climate change") reflects only about half the eventual total warming ("equilibrium climate change").

Observational data reveal that, in recent decades, some climate extremes are already increasing in response to relative modest warming; these extremes would likely increase considerably with warming of 2°C or more. While the findings suggest that even at relatively low levels of global warming the world will have to face significant sea level rise, the studies also demonstrate that the potential impacts are substantially greater if we allow warming to reach a level as high as 2°C. If they occur, changes such as these would not rapidly reverse, as even if the atmospheric CO_2 amount declines, it would take many centuries for the deep ocean to cool.

To prevent exceeding 450 ppm CO_2e, developed countries must substantially reduce their emissions in the near term. The 2008 World Energy Outlook suggests that Organisation for Economic Co-operation and Development (OECD) countries must reduce emissions by about 40 percent below 2006 levels by 2030.[18] The Union of Concerned Scientists has suggested a 2030 emissions target for the United States of 56 percent below 2005 levels (44 percent below 1990 levels).[19] A governmental study from the Netherlands finds that Europe would have to reduce emissions by 47 percent below 1990 levels and the United States would have to reduce emissions by 37 percent below 1990 levels by 2030.[20] The International Energy Agency comes to a similar conclusion, finding that the United States would have to reduce emissions by about 38 percent below 1990 levels by 2030.[21] Note that percent reductions by 2030 depend on the assumed overall trajectory of emissions, including the amount after 2030.

Because of the cumulative effects of GHG emissions and resultant changes to the earth's energy balance and the inertia in the climate system, delaying efforts to reduce emissions will likely mean that global average temperature will increase by more than 2°C, increasing the costs associated with combatting climate change. Reducing the global concentration to 450 ppm CO_2e after delaying mitigation actions for ten more years is estimated to cost an additional $3.5 trillion, compared to levels of investment needed now if low-carbon strategies were to be adopted immediately.[22]

17 R. Monastersky (2013). Global carbon dioxide levels near worrisome milestone. Nature News: *www.nature.com/polopoly_fs/1.12900%21/menu/main/topColumns/topLeftColumn/pdf/497013a.pdf*.

18 IEA. 2008. World Energy Outlook 2008. International Energy Agency. *www.worldenergyoutlook.org/publications/2008-1994/*.

19 Cleetus, R. et al. 2009. Climate 2030: A National Blueprint for a Clean Energy Economy. Union of Concerned Scientists. May. *www.ucsusa.org/blueprint*.

20 Hof, A. et al. 2012. Greenhouse gas emission reduction targets for 2030. Conditions for an EU target of 40%. The Hague: PBL Netherlands Environmental Assessment Agency. *www.pbl.nl/sites/default/files/cms/publicaties/PBL_2012_Greenhouse-gas-emission-reduction-targets-for-2030_500114023.pdf*.

21 IEA, 2012. Energy Technology Perspectives 2013: Pathways to a Clean Energy System. International Energy Agency. *www.iea.org/etp/etp2012/*

22 IEA. 2013. Redrawing the Energy Map: World Energy Outlook Special Report. International Energy Agency. June 10. *www.worldenergyoutlook.org/energyclimatemap*.

C. Climate Pollutants

The standard definition of greenhouse gases includes six substances identified in the Kyoto Protocol – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) – plus chlorofluorocarbons and other chlorine or bromine-containing gases phased out under the Montreal Protocol. Other GHGs include synthetic gases recently added to the IPCC's AR5 report such as nitrogen trifluoride (NF_3) and sulfuryl fluoride (SO_2F_2). Tropospheric ozone (O_3), a short-lived, not-well-mixed gas, and black carbon are also important climate pollutants. Carbon dioxide is undoubtedly the most important GHG, and collectively CO_2, CH_4, and N_2O amount to 80 percent of the total radiative forcing from well-mixed GHGs.

Carbon dioxide, methane and nitrous oxide concentrations have increased in the atmosphere since pre-industrial times, and this increase is the main driver of climate change. Globally, CO_2 increased by 40 percent from 278 ppm circa 1750 to 390.5 ppm in 2011. During the same time interval, CH_4 increased by 150 percent, from 722 ppb[23] to 1,803 ppb, and N_2O by 20 percent, from 271 ppb to 324.2 ppb in 2011. The increase of CO_2, CH_4, and N_2O is caused by anthropogenic emissions from the use of fossil fuel as a source of energy, fertilizer usage, and from land use and land use change—in particular, agriculture.

For each GHG, a global warming potential (GWP) has been calculated to reflect how long emissions remain in the atmosphere and how strongly it absorbs energy on a per-kilogram basis relative to CO_2. GWP is a metric that indicates the relative climate forcing of a kilogram of emissions when averaged over the period of interest (both 20-year and 100-year horizons are used for the GWPs shown in Table 1). Other important climate-forcing species not listed under the Kyoto Protocol with large human sources are tropospheric ozone and particulate matter (PM, including black carbon and other absorbing organic carbon aerosols).

Tropospheric ozone can act as a direct GHG and as an indirect controller of GHG lifetimes. Ozone is not emitted directly into the atmosphere, but rather formed by photochemical reactions. Its average atmospheric lifetime of a few weeks produces a global distribution highly variable by season, altitude, and location. The radiative forcing of tropospheric ozone is primarily attributed to emissions of methane, but also to carbon monoxide, volatile organics, and nitrogen oxides that eventually form ozone.

Unlike other GHGs, the three main categories of fluorinated gases (HFCs, PFCs, and SF_6) have no natural sources and only come from human-related activities. Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) are also potent climate-forcing fluorinated gases, but they are regulated under the Montreal Protocol because of their role in the destruction of the protective stratospheric ozone layer. The fluorinated gases are used as refrigerants, foam-blowing agents, or for a variety of industrial processes such as aluminum and semiconductor manufacturing. Many fluorinated gases have very high GWPs relative to other GHGs, so relatively low atmospheric levels can have large effects on global temperatures. They can also have long atmospheric lifetimes, lasting thousands of years in the case of SF_6. Recently, two new climate pollutants were added to the list of climate pollutants of concern in the IPCC's AR5 report. These gases are NF_3, used in the electronics industry, and SO_2F_2, used as a fumigant to replace methyl bromide. Both have rapidly increasing emissions (growing from almost zero in 1978), but they currently contribute only about 0.0001 watt per square meter (W/m^2) and 0.0003 W/m^2, respectively, to anthropogenic radiative forcing. For comparison, industrial era radiative forcing for CO_2 alone is about 1.82 W/m^2 and CO_2 is the component with the largest global mean radiative forcing.

23 Note: one part-per-million (ppm) = 1,000 parts-per-billion (ppb)

Globally, CO_2 is the fastest increasing GHG in terms of absolute CO_2-equivalents. In California, since CO_2 emissions are decreasing due to AB 32 and other regulations, the fastest growing sector of GHG emissions are the high-GWP substitutes to ozone-depleting substances, primarily the HFCs. An important outcome of conducting a state or regional specific F-gas emission inventory (rather than relying on scaled-down national estimates) was highlighted by the discovery of a regional anomaly of relatively high GHG emissions in California from sulfuryl fluoride. In 2006, the reported SO_2F_2 pesticide use in California represented 37–56 percent of the global usage estimate and 41–75 percent of the U.S. usage estimate.[24] Gallagher, et al.[25] estimated that, in 2008, SO_2F_2 contributed 4.6 $MMTCO_2e$, or nine percent of all Fgas emissions in California (51.0 $MMTCO_2e$). Nitrogen trifluoride's contribution was only 0.17 $MTCO_2E$, or 0.3 percent of all F-gas emissions in California.

Short-Lived Climate Pollutants: As mentioned above, GHGs have different atmospheric lifetimes, ranging from less than a year to thousands of years (see Table 1). Some GHGs, such as CO_2 and N_2O, are long-lived GHGs, and so contribute to long-term climate change. Other substances have shorter atmospheric lifetimes because they are removed fairly quickly from the atmosphere. Therefore, their effect on the climate system is similarly short-lived. Together, these short-lived climate forcers are responsible for a significant amount of current climate forcing from anthropogenic substances.

The differentiation between long- and short-lived GHGs is not well defined, and here we define it to be gases with lifetimes less than 20 years so that a substantial fraction of emissions (>60 percent) decays within a 20-year horizon, and thus mitigation of emissions will rapidly reduce the warming caused by these chemical species. Properties of these short-lived climate pollutants (SLCP)—including black carbon, methane, and some hydrofluorocarbons (HFCs)—are contrasted with the other Kyoto GHGs in Table 1. Key SLCPs are described in more detail in the following sections.

24 Mühle, J., J. Huang, R. F. Weiss, R. G. Prinn, B. R. Miller, P. K. Salameh,C. M. Harth, P. J. Fraser, L. W. Porter, B. R. Greally, S. O'Doherty,and P. G. Simmonds. 2009. Sulfuryl Fluoride in the Global Atmosphere. J.Geophys. Res. 114.D5: D05306.

25 Gallagher, G.; Zhan, T.; Hsu, Y-K.; Gupta, P.; Pederson, J.; Croes, B.; Blake, D. R.; Barletta, B.; Meinardi, S.; Ashford, P.; Vetter, A.; Saba, S.; Slim, R.; Palandre, L.; Clodic, D.; Mathis, P.; Wagner, M.; Forgie, J.; Dwyer, H.; Wolf, K. 2014. High-global Warming Potential F-gas Emissions in California: Comparison of Ambient-based versus Inventory-based Emission Estimates, and Implications of Refined Estimates. Environ Sci. Technol., 48, 1084–1093.

Table 1: Global Warming Potential for Selected Greenhouse Gases*

Pollutant	Lifetime (years, except for BC)	Global Warming Potential (20-year)	Global Warming Potential (100-year)*
Long-Lived			
Carbon dioxide	~100**	1	1
Nitrous oxide	121	264	265
Nitrogen trifluoride	500	12,800	16,100
Sulfur hexafluoride	3,200	17,500	23,500
Perfluorocarbons	3,000–50,000	5,000–8,000	7,000–11,000
Short-Lived (<20 years)			
Black Carbon***	days to weeks	270–6,200	100–1,700
Methane	12	84	28
Hydrofluorocarbons****	(<1 to >100)	~100–11,000	~100–12,000

* The 20- and 100-year global warming potential estimates are from the IPCC 2013 Fifth Assessment Report (AR5),[26] which includes the independent scientific assessment of the black carbon radiative forcing published early this year.[27]

** CO_2 has a variable atmospheric lifetime and cannot be readily approximated as a single number.

*** BC climate effects are highly uncertain, in large part because they depend on the conditions under which they are emitted (i.e., location and time of year). This type of uncertainty does not apply to the Kyoto greenhouse gases.

**** HFCs have a wide range of lifetimes—some long, some short by this definition. Correspondingly, they have a wide range of GWPs.

Mitigation of the four SLCPs (methane, HFCs, tropospheric ozone, and black carbon), even if we are restricted to available technologies, can reduce the probability of exceeding the 2°C barrier before 2050 to less than ten percent, and before 2100 to less than 50 percent.[28,29] In addition, mitigation of CO_2 along with SLCPs can keep the twenty-first century warming below 2°C and 21th Century sea level rise below one meter.[30] However, the most immediate health and climate benefits would accrue regionally to the nations undertaking actions to mitigate SLCPs. For example, reducing black carbon emissions would help to minimize soot deposition on snowpacks and glaciers, which is known to accelerate snowmelt from the Sierra Nevada snowpack.[31,32]

26 Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura, and H. Zhang. 2013. Anthropogenic and Natural Radiative Forc¬ing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 659–740.

27 Bond, T. C., S. J. Doherty, D. W. Fahey, et al. 2013. "Bounding the role of black carbon in the climate system: A scientific assessment." Journal of Geophysical Research: Atmospheres doi:10.1002/jgrd.50171.

28 Ramanathan, V., and Y. Xu. 2010. "The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues." Proc. Nat. Acad. Sci. 107 (18) 8055–8062. *www-ramanathan.ucsd.edu/files/pr175.pdf*.

29 UNEP/WMO. 2011. Integrated Assessment of Black Carbon and Tropospheric Ozone. Available at *www.unep.org/dewa/Portals/67/pdf/BlackCarbon_report.pdf*.

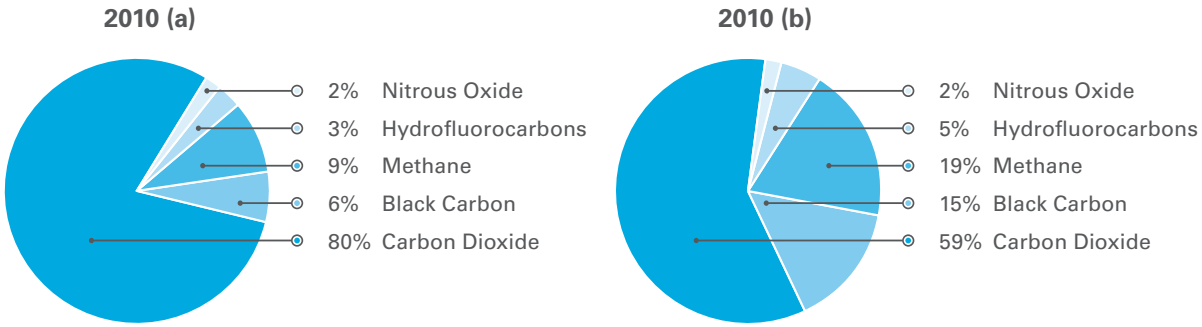
30 Hu, A., Y. Xu, C. Tebaldi, W. M. Washington, and V. Ramanathan. 2013. "Mitigation of short-lived climate pollutants slows sea-level rise." Nature Climate Change 3(5): 1–5, doi:10.1038/nclimate1869. *www-ramanathan.ucsd.edu/files/pr194.pdf*.

31 Hadley, O. L., C. E. Corrigan, T. W. Kirchstetter, S. S. Cliff, and V. Ramanathan. 2010. "Measured black carbon deposition on the Sierra Nevada snow pack and implication for snow pack retreat." Atmos. Chem. Phys. 10: 7505–7513, doi:10.5194/acp-10-7505-7513.

32 Qian, Y., W. I. Gustafson, Jr., L. Y. R. Leung, and S. J. Ghan. 2009. "Effects of soot-induced snow albedo change on snowpack and hydrological cycle in western United States based on Weather Research and Forecasting chemistry and regional climate simulations."Journal of Geophysical Research D. (Atmospheres) 114:D03108. doi:10.1029/2008JD011039.

Figure 1 shows the relative GWP-weighted contributions of 2010 California emissions of different climate pollutants for 100-year and 20-year time horizons. Note that Figure 1 does not include other SLCPs such as NO_X, CO, VOCs, and organic aerosols, which have both positive and negative GWPs, as described in the 2013 IPCC AR5. Use of a global annual average GWP for BC may significantly over- or under-estimate the contribution of California's BC emissions. Individual HFC species are aggregated according to their specific emissions and GWPs. The 20-year GWP is a better reflection of what can be achieved in the near term by mitigation.

Figure 1: Carbon Dioxide Equivalent Climate Pollutant Emissions for 2010 in California Using (a) 100-year and (b) 20-year Horizon GWPs



Many short-lived climate pollutants are already regulated by ARB, either as part of the air quality and toxics program or under the Scoping Plan. The following sections describe the major short-lived climate pollutants and ARB's past programs to reduce emissions. For many of these pollutants, ARB is proposing additional action to investigate and potentially require additional emission reductions prior to 2020. In addition to actions under way, described in Chapter IV, ARB will develop a short-lived climate pollutant strategy by 2015 that will include an inventory of sources and emissions, the identification of additional research needs, and a plan for developing necessary control measures. ARB will consult with external experts in the development of this strategy.

1. Black Carbon

Black carbon is the most strongly light-absorbing component of particulate matter (PM) emitted from burning fuels such as coal, diesel, and biomass. ARB identified diesel PM as a toxic air contaminant in 1998, and PM that can be inhaled (PM_{10} and $PM_{2.5}$) is a criteria pollutant, which is regulated by both the U.S. Environmental Protection Agency (U.S. EPA) and ARB. Black carbon contributes to climate change both directly by absorbing sunlight and indirectly by depositing on snow and by interacting with clouds and affecting cloud formation. Reducing black carbon emissions globally can have immediate economic, climate, and public health benefits.[33, 34, 35]

Short-lived species, like BC, vary spatially and, consequently, it is very difficult to quantify their global-warming forcing. Due in large part to the difference in lifetimes between BC and CO_2, the relative weight given to BC as compared to CO_2 (or other climate forcers) is very sensitive to the formulation of the metric used to make the comparison. Several leading scientists have reported

33 UNEP and WMO. 2011. Integrated Assessment of Black Carbon and Tropospheric Ozone. United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO).

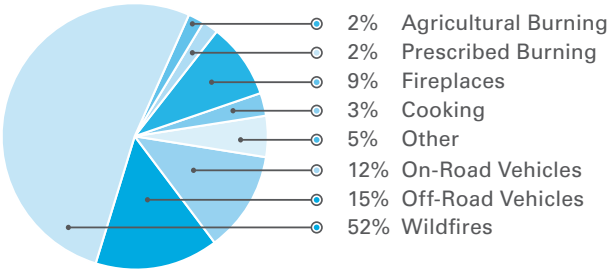
34 Shindell, D., J. C. I. Kuylenstierna, E. Vignati, R. van Dingenen, M. Amann, Z. Klimont, S. C. Anenberg, N. Muller, G. Janssens-Maenhout, F. Raes, J. Schwartz, G. Faluvegi, L. Pozzoli, K. Kupiainen, L. Höglund-Isaksson, L. Emberson, D. Streets, V. Ramanathan, K. Hicks, N. T. K. Oanh, G. Milly, M. Williams, V. Demkine, and D. Fowler. 2012. "Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security." Science 335 (6065): 183–189. doi: 10.1126/science.1210026.

35 Wallack, J., and V. Ramanathan. 2009. "The Other Climate Changes, Why Black Carbon Also Matters." Foreign Affairs Sept/Oct 2009: 105–113. *www-ramanathan.ucsd.edu/files/pr168.pdf*.

estimates of the GWP for BC emissions from different sources. Most of the regional differences in GWP are caused by differences in the lifetime of BC. In general, in the published literature, there are significant variations in the GWP values for BC emissions assigned to different regions. This indicates that the role of BC in warming requires close attention to the geography of emissions. Black carbon may also indirectly cause changes in the absorption or reflection of solar radiation through changes in the properties and behavior of clouds, e.g., BC localized warming in the lower atmosphere can prevent cloud formation.

Figure 2 shows the statewide contribution from black carbon emissions sources in 2010. The main sources of black carbon in California are wildfires, off-road vehicles (locomotives, marine vessels, tractors, excavators, dozers, etc.), on-road vehicles (cars, trucks, and buses), fireplaces, agricultural waste burning, and prescribed burning (planned burns of forest or wildlands). Wildfires are a highly intermittent but significant source—almost 50 percent of the total black carbon emissions. Emissions in this category may grow significantly in the future if climate change results in increased wildfires, as predicted in many climate model scenarios. Projections suggest that the frequency and size of forest fires is expected to increase, perhaps several fold, by the end of the century.

Figure 2: California Black Carbon Emissions Sources (2010)



California has been an international leader in reducing emissions of black carbon, with close to 95 percent control expected by 2020 due to existing programs that target reducing PM from diesel engines and burning activities.

Due to the health concerns from PM exposures, both ARB and local air districts have developed programs to reduce emissions from these sources (Table 2). These efforts have concurrently resulted in significant reductions of black carbon and GHG emissions.

ARB estimates that the annual black carbon emissions in California decreased about 70 percent between 1990 and 2010, in direct proportion to declining diesel PM emissions—a benefit of ARB's regulations on diesel fuel and engines. PM emissions from other categories of diesel engines, such as off-road (e.g., agricultural and construction equipment), building equipment, generators, ships, and harbor craft are also projected to decline significantly by 2020. Continued efforts to better manage agricultural, forest, and range land burning operations are also expected to continue to reduce black carbon emissions.

Table 2: Programs Resulting in Black Carbon Emission Reductions

Program Area	Adoption Dates
Prescribed and Agricultural Burning (ARB, Districts)	1970, 1972, 1973, 1974, 1976, 1991, 1997, 2004
Fireplaces and Fire Pits (Districts)	1986, 1993, 1995, 1996, 2004, 2006, 2008, 2013
Heavy-Duty On-Road Engine Particulate Standards (ARB, U.S. EPA)	1987, 1997, 2000, 2001
Diesel and Gasoline Fuel Specifications (ARB, U.S. EPA)	1988, 1991, 1999, 2003
Low Emission Vehicle Programs (LEV I, II, III) (ARB)	1990, 1998, 2012
Off-Road Engine Standards (ARB, U.S. EPA)	1994, 1997, 1998, 1999, 2002, 2004, 2006, 2008, 2009
Smog Check Program (ARB and Bureau of Automotive Repair)	1984,1998, and 2013
Local Commercial Charbroiling Rules (South Coast, San Joaquin Valley, and Ventura Air Districts)	1997, 2002, 2004
Diesel Clean-up Incentive Programs – Carl Moyer, AB 118 Air Quality Improvement Program, Proposition 1B (ARB, Districts)	1998, 2007
In-Use Fleet Rules (Drayage and Truck/Bus) (ARB)	2000, 2003, 2005, 2007, 2009
Ship Engine and Fuels Standards (ARB and U.S. EPA)	1999, 2002, 2007, 2008, 2010
Federal Diesel Emission Reduction Act (DERA) Incentive Programs (U.S. EPA)	2008
Federal Environmental Quality Incentives Program (EQIP) (U.S. Department of Agriculture)	2008

California is committed to continuing to reduce emissions of black carbon, to meet ongoing air quality and climate targets. Regulations requiring diesel particulate retrofits and legacy fleet turnover are critical for obtaining necessary reductions. However, advanced technologies in the freight system, including zero- or near-zero emission vehicles and fuels, will also be needed to meet future air quality and climate goals.

2. Methane

Methane (CH_4) is the principal component of natural gas and is also produced biologically under anaerobic conditions in ruminants, landfills, and waste handling. Atmospheric methane concentrations have been increasing as a result of human activities related to agriculture, fossil fuel extraction and distribution, and waste generation and processing. The radiative efficiency of CH_4 per unit concentration is relatively large in comparison to CO_2, and coupled to the significant increase in its concentration, methane is the second most important anthropogenic GHG in the atmosphere. Anthropogenic warming will likely lead to enhanced CH_4 emissions from both terrestrial and oceanic clathrates, but it is unclear if this will significantly increase atmospheric CH_4 abundances.

Methane contributes to background tropospheric ozone levels. Photo-oxidation of both methane and carbon monoxide lead to net production of global ozone. With multi-decadal full-chemistry transient simulations in the MOZART-2 global model of tropospheric chemistry model, Fiore et al[36] show that tropospheric ozone responds approximately linearly to changes in CH_4 emissions. Controlling methane emissions may be a promising means of simultaneously mitigating climate

36 Fiore, A.M., J.J. West, L.W. Horowitz, V. Naik, and M.D. Schwarzkopf (2008), Characterizing the Tropospheric Ozone Response to Methane Emission Controls and the Benefits to Climate and Air Quality , J. Geophys. Res. , 113, D08307, doi:10.1029/2007JD009162.

change and reducing global ozone concentrations.[37, 38]Tropospheric ozone can also act as a direct GHG and as an indirect controller of GHG lifetimes. Concentrations of ozone have risen by around 30 percent since the pre-industrial era and it is now considered by the IPCC to be the third most important greenhouse gas after carbon dioxide.[39]

As noted in Table 1, the current methane GWP for a time horizon of 20 years is 84 (from the IPCC 2013 Fifth Assessment Report), which, combined with its large emissions, makes it an attractive target for near-term climate mitigation policies. Although the methane GWP traditionally includes the methane indirect effects on the concentrations of ozone and stratospheric water vapor, it does not take into account the production of carbon dioxide from methane oxidation. Recent studies argue that this CO_2-induced effect should be included for fossil sources of methane, which adds about three to the GWP values for all time horizons. Boucher et al. recommend somewhat larger values for the methane GWP than suggested by the IPCC 2007 Fourth Assessment report (AR4).[40] When the methane comes from fossil sources, the 100-year GWP would be about 30. Holmes et al. also provide a new estimate of the indirect components of methane climate forcing.[41] Tropospheric ozone contributes 30–50 percent of the direct methane climate forcing, compared to 25 percent that has been used in previous IPCC assessments. Hence, accounting for the indirect effect of methane emissions could have an even larger relative impact. In the IPCC AR5 report, when feedbacks are included, the GWP for methane was increased, from 25 to 28 over a 100-year timespan, and from 72 to 84 over a 20-year timespan.

The State's largest anthropogenic methane-producing sources are enteric fermentation (belching by animals), manure management, landfills, natural gas transmission, and wastewater treatment (Figure 3). Methane emissions also come from non-anthropogenic sources such as wetlands, oceans, forests, fires, terrestrial arthropods (such as termites), and geological sources (such as submarine gas seepage, micro seepage over dry lands, and geothermal seeps). Methane gas from production and distribution is a growing source of emissions in many countries, including the United States, due to increased exploration and use of natural gas for energy.

Methane is generated in landfills during the natural process of bacterial decomposition of organic material. Many factors influence the quantity and composition of the gas generated, including the types and age of waste buried in the landfill, the quantity and types of organic compounds in the waste, and the moisture content and temperature of the waste. California has adopted several measures focused on controlling methane emissions from landfills and other sources (Table 3). Local air districts have adopted rules to implement the federal New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants for municipal solid waste (MSW) landfills, which also require installation of gas collection and control systems. These district rules target reductions in ozone precursors and hazardous air pollutants, but also provide supplemental methane reductions. In 2009, ARB adopted a regulation to reduce methane from MSW landfills. The regulation requires owners and operators of certain uncontrolled MSW landfills to install gas collection and control systems, and requires existing and newly installed gas and control systems to operate in an optimal manner. Complementary to the control of methane emissions from landfills themselves, the Mandatory Commercial Recycling Regulation

37 Anenberg S, Schwartz J, Shindell D, Amann M, Faluvegi G, Klimont Z, Janssens-Maenhout G, Pozzoli L, Van Dingenen R, Vignati E, et al. Global Air Quality and Health Co-benefits of Mitigating Near-Term Climate Change through Methane and Black Carbon Emission Controls. ENVIRON HEALTH PERSP. 2012;120 (6):831-839.

38 Shiri Avnery, Denise L. Mauzerall, Arlene M. Fiore. Increasing global agricultural production by reducing ozone damages via methane emission controls and ozone-resistant cultivar selection Glob Change Biol, Vol. 19, No. 4. (1 April 2013), pp. 1285-1299, doi:10.1111/gcb.12118.

39 Kirtman, B., S. B. Power, J. A. Adedoyin, G. J. Boer, R. Bojariu, I. Camilloni, F. J. Doblas-Reyes, A. M. Fiore, M. Kimoto, G. A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G. J. van Oldenborgh, G. Vecchi, H. J. Wang. 2013. Chapter 11: Near-term Climate Change: Projections and Predictability. In: Climate Change 2013: The Physical Science Basis. Contribution of WGI to the 5th AR of the IPCC [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K.]

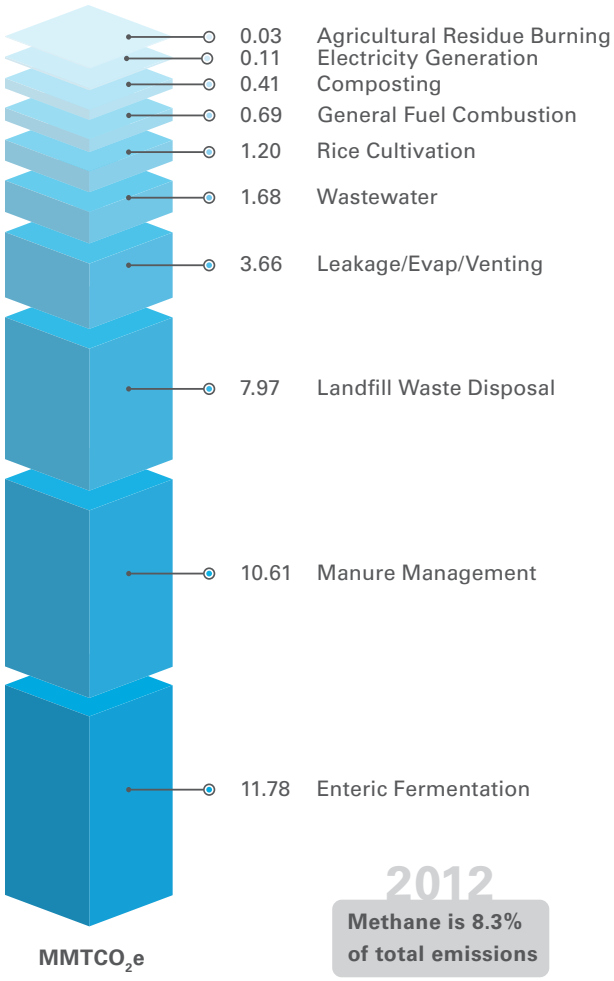
40 Holmes, C. D., M. J. Prather, O. A. Sovde, and G. Myhre. 2013. "Future methane, hydroxyl, and their uncertainties: Key climate and emission parameters for future predictions." Atmospheric Chemistry and Physics 13: 285–302.

41 Boucher, O., P. Friedlingstein, B. Collins, and K. P. Shine. 2009. "The indirect global warming potential and global temperature change potential due to methane oxidation." Environmental Research Letters, 4, 044007.

(AB 341; Chesbro, Chapter 476, Statutes of 2011) was adopted in 2012 to further reduce landfill methane emissions via upstream organic material diversion from landfill disposal. ARB and CalRecycle continue to assess new information on landfill methane emissions to determine whether additional actions in support of GHG emissions and the 75 percent goal are warranted.

Methane is also emitted from oil production and the natural gas industry. Natural gas transmission involves high-pressure, large-diameter pipelines that transport gas long distances from field production areas to distribution systems for ultimate customer use. Methane is emitted from venting and leaks of processing equipment and pipelines.

Figure 3: California Methane Emission Sources (2012)



ARB's Cap-and-Trade Program includes an offset protocol to reduce methane from dairies. The Compliance Offset Protocol Livestock Projects provides methods to quantify and report GHG emission reductions associated with the installation of a biogas control system for manure management on dairy cattle and swine farms. The protocol is designed to ensure complete, consistent, transparent, accurate, and conservative quantification of GHG emission reductions associated with a livestock digester project for generating ARB offset credits.

In addition, ARB's Low Carbon Fuel Standard incentivizes the capture and use of natural gas from landfills and digesters for transportation fuel.

Table 3: Programs Resulting in Methane Emission Reductions

Program Area	Adoption Dates
Control of landfill emissions (local air districts)	Varies
Standards of Performance for Municipal Solid Waste Landfills (U.S. EPA)	1996
Landfill Methane Control Measure (ARB)	2009
Methane inclusion in Low Carbon Fuel Standard (ARB)	2009
Dairy digester protocol for offsets in Cap-and-Trade Program (ARB)	2011
Landfill waste diversion, Assembly Bill 341 (CalRecycle)	2011
Proposed oil and gas production, processing, and storage regulation (ARB)	In progress, expected 2014

Several recent analyses of atmospheric measurements suggest that actual methane emissions may be 1.3 to 1.7 times higher than estimated in ARB's emission inventory.[42, 43] Recent research suggests that methane emissions from a broad variety of sources could be higher than previously expected, including leaks in natural gas distribution systems, oil and gas extraction facilities, and natural seeps such as the La Brea Tar Pits. Underestimations may explain the discrepancies between the inventory and atmospheric measurements. With the greater GWP assessed in recent IPCC and other studies, reductions in methane emissions will have greater benefits.

ARB is continuing to research potential sources of methane emissions to determine the source of higher-than-expected ambient methane measurements, and whether additional controls are technologically feasible and cost-effective.

42 Y.-K. Hsu, T. VanCuren, S. Park, C. Jakober, J. Herner, M. FitzGibbon, D. R. Blake, and D. D. Parrish. 2010. "Methane emissions inventory verification in southern California." Atmospheric Environment 44: 1 7.

43 S. M. Miller, S. C. Wofsy, A. M. Michalak, E. A. Kort, A. E. Andrews, et al. 2013. Anthropogenic emissions of methane in the United States. PNAS doi/10.1073/pnas.1314392110.

SUCCESS STORY

Only 24 ounces of the most commonly used automobile air conditioning refrigerant captures as much heat in the atmosphere as a ton of carbon dioxide. Thanks to California's regulations, automakers are now beginning to use a refrigerant for vehicle air-conditioning system that is 350 times less damaging to the climate. The 2004 Pavley regulations—the first standards designed to reduce GHGs from vehicles—created credits for less climate-damaging coolants. The European Union later followed suit. As a result, Du Pont developed "HFO-1234yf," a refrigerant with a global warming potential only four times that of carbon dioxide. The new refrigerant is now being introduced by General Motors and Chrysler, including models such as the 2014 Dodge Dart, Dodge Charger, Chrysler 300 and Ram 1500.

3. Hydrofluorocarbons

Hydrofluorocarbons are synthetic gases used in refrigeration, air conditioning, insulating foams, solvents, aerosol products, and fire protection. They are primarily produced for use as substitutes for ozone-depleting substances which are being phased out under the Montreal Protocol. Currently, HFCs are a small fraction of the total climate forcing (<1 percent), but their emissions are growing relatively more rapidly than those of CO_2. Recent scientific studies project substantial growth in the use of HFCs in the coming decades, primarily driven by the increased demand for refrigeration and air conditioning in developing countries. Recently, the United States, China, and 24 other countries agreed to work to phase out the use of HFCs.

ARB has implemented several measures to reduce HFC emissions (Table 4). These include low-GWP requirements for aerosol propellants, a deposit-return recycling program for small cans of motor vehicle air-conditioning (AC) refrigerant, and the Refrigerant Management Program. In addition, beginning with 2017 model year vehicles, the national Clean Cars Initiative is expected to significantly reduce motor vehicle air-conditioning refrigerant emissions.

Table 4: Programs Resulting in HFC Emission Reductions

Program Area	Adoption Dates
Semiconductor regulation (ARB)	2007
Refrigerant Management Program (ARB)	2009
High global warming potential gas ban for non-essential consumer products (ARB)	2009
Regulation for small containers of automotive refrigerant (ARB)	2009
Ozone depleting substance protocol for offsets under the Cap-and-Trade Program (ARB)	2011
Advanced Clean Car credit for mobile air-conditioning systems (ARB)	2012

D. Greenhouse Gas Monitoring Efforts

Monitoring and measurement efforts are a crucial component of the regulatory process, because they provide objective measures to identify the need for regulatory action and to verify the performance of implemented regulations.

Since the adoption of the original Scoping Plan, ARB has spearheaded and participated in various measurement-based research studies to verify statewide GHG emission inventory, identify and understand unknown GHG emission sources and under-inventoried sectors, identify possible measures for emission mitigation, and evaluate program effectiveness through monitoring long-term trends. The most significant part of these efforts is the Greenhouse Gas Research Monitoring Network that was initiated by ARB in 2010. Network participants evaluate the regional and statewide inventories to support the AB 32 program and study the regional GHG emissions trends throughout the state and provide data at a regional level to monitor AB 32-related reductions and effectiveness. The network currently has seven ARB-operated monitoring stations, and four additional stations are operated by leading researchers throughout the state. The network captures real-time GHG data throughout the state in high temporal and spatial resolution and uses high-precision analyzers to study CH_4, N_2O, and CO_2 emissions.

Data from this network have been used for monitoring and verification, and for inverse receptor-oriented modeling to estimate natural and anthropogenic sources and sinks of GHGs. These types of highly accurate and consistent measurements have been immensely valuable to evaluate and improve ARB's GHG emission inventory. For example, the results suggested that the current CH_4 inventory may be underestimated by a factor of 1.3 to 1.7, and the current N_2O inventory may be underestimated by a factor of up to 2.7. A range of research studies in the state have also identified potential sources of under-estimation in the inventory. Those studies suggest that

livestock and landfills may be the largest sources of underestimated GHG emissions in California's Central Valley; whereas, the fossil fuel sector, primarily from natural gas transmission and distribution systems, may be responsible for a larger fraction of CH_4 emissions in the South Coast.

ARB is also actively participating in the Megacities Carbon Project[44], which plans to develop and test methods for monitoring GHG emissions from megacities, with the ultimate aim of establishing a global urban monitoring framework. The Megacities project relies on sustained monitoring of the various GHGs and applies scientifically robust analyses for linking monitored concentrations to emission activity. The goal is to provide decision makers with critical information for assessing the ultimate efficacy of emission mitigation policies, and to review the progress in reducing carbon emissions from cities. The Megacities team has partnered with ARB to use the GHG Research Monitoring Network data in the South Coast Air Basin. ARB is also helping the Megacities team coordinate project planning, identify potential sites for adding their monitoring locations, and analyze concentration trends.

ARB has also expanded its Mobile Measurement Platform program to monitor and measure GHGs from various under-reported and un-inventoried sources to improve the existing emissions inventories. These efforts include quantifying GHG emission fluxes from various sources in the field, developing and comparing emission factors against the inventory data, and providing emissions data for ARB inventory groups for regulatory and mitigation planning. In the recent past, this program has been successful in verifying GHG emission rates of complex sources such as natural gas compression stations and landfills. ARB is also expanding the program to include flux chambers and controlled tracer release studies to study large area sources such as landfills, wastewater treatment plants, oil and gas extraction fields, natural gas leakage from pipelines, and other fugitive emission sources. These wide-ranging collaborations and the integration of various methods will continue to provide a comprehensive approach to evaluate and validate the California GHG inventory and identify possible measures for emission mitigation in the future.

E. Adjusting the 2020 Statewide Limit

The Scoping Plan relied on the IPCC's 1996 Second Assessment Report (SAR) to assign the global warming potentials (GWPs) of greenhouse gases. Recently, in accordance with the United Nations Framework Convention on Climate Change (UNFCCC), international climate agencies have agreed to begin using the scientifically updated GWP values in the IPCC's Fourth Assessment Report (AR4)[45] that was released in 2007. ARB is beginning to transition to the use of the AR4 100-year GWPs in its climate change programs. ARB has recalculated the 1990 GHG emissions level with the AR4 GWPs to be 431 $MMTCO_2e$, therefore the 2020 GHG emissions limit established in response to AB 32 is now slightly higher than the 427 $MMTCO_2e$ in the initial Scoping Plan. More information is provided in Chapter IV, Section B(3). The IPCC AR5 was just completed (September 2013), and the scientific updates have again altered the GWPs, as discussed above. Use of AR5 GWPs will be considered in subsequent reports.

44 More information on the Megacities Carbon Project is available at: *http://megacities.jpl.nasa.gov/portal*.

45 IPCC Fourth Assessment Report (AR4), Climate Change 2007: Synthesis Report;

GWP values and lifetimes from 2007 IPCC AR4	Lifetime (years)	GWP time horizon		
		20 years	100 years	500 years
Methane	12	72	25	7.6
Nitrous oxide	114	289	298	153
HFC-23 (hydrofluorocarbon)	270	12,000	14,800	12,200
HFC-134a (hydrofluorocarbon)	14	3,830	1,430	435
Sulfur hexafluoride	3200	16,300	22,800	32,600

www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

III. California's Approach to Climate Change

California's commitment to addressing climate change is born of necessity. As described in Chapter II, our State, economy, and rural and urban communities are especially vulnerable to the impacts of climate change. Many studies have shown that the costs of inaction or delayed action to reduce GHG emissions far outweigh the costs—and come with none of the benefits—associated with reducing emissions today by deploying clean technologies, diversifying energy supplies, and strengthening and preserving natural lands. But our commitment is not just a defensive one focused on minimizing the costs or inevitable impacts of climate change within our State.

California is taking a proactive approach to climate change policy, through integrated policy and planning that will build a higher-quality, resilient economy while continually reducing GHG emissions. The State is continuing its legacy of creating a future where a strong economy, environmental protection, improved public health, and a higher quality of life increasingly reinforce one another. After decades of progress, the realization of a clean energy economy is the enviable future that we must create if we are to adequately address climate change.

California has asserted, and reasserted, its commitment to responsible climate policy and planning through the passage and implementation of AB 32, the overwhelming rejection of Proposition 23 in 2010, and through numerous other state and local policies, corporate commitments, and individual actions to reduce emissions.

Climate change is a continuous, global phenomenon, defined by cumulative emissions, rather than emissions at a given point in time. Policies and measures put in place and implemented today – and the continued implementation of already adopted measures – will affect emissions levels after 2020; additional planning is needed now to begin designing policies to continue reducing GHG emissions in order to achieve our long-term climate goals. With climate change already upon us and scientific consensus-based targets only sufficient to avert its very worst impacts, a continuum of action is needed to achieve the maximum technologically feasible and cost-effective emission reductions available at any given time—and to work toward near-zero emissions as soon as possible. Each incremental, cost-effective emission reduction puts California closer to its essential, sustainable future—where economic growth is unencumbered by environmental, resource, or health constraints.

California is not alone in its commitment to reduce emissions. Many other states— including Oregon, Washington, the northeast states in the Regional Greenhouse Gas Initiative, and others—are taking concrete steps to reduce GHG emissions. The United States is on track to meet the goals of the Obama Administration to reduce emissions to 17 percent below 2005 levels by 2020, and numerous other national and subnational governments in Canada, Mexico, China, Australia, Europe, and elsewhere are pricing carbon emissions, establishing markets for clean energy technologies, and taking other steps to reduce GHG emissions.

But California is alone in its depth of vision, scope of planning, and degree of leadership in demonstrating effective climate policies to decouple GHG emissions from economic growth and ensuring the State reduces emissions at a rate consistent with scientifically based targets on an ongoing basis. California's approach is one firmly grounded in science and public process, built from coordinated, integrated planning and cost-effective policy design, and accomplished through consistent, fair policy implementation. Continuing to build on this successful framework will foster broader action and continued progress on a global scale to address climate change—and deliver even greater benefits to California's economy, environment, and quality of life.

A. Preserve the California Lifestyle

California is a collection of farmers, surfers, factory workers, outdoor enthusiasts, tech geeks, truckers, world-class researchers, celebrity actors, and many more—who come from all around the world to live and work in one of the most beautiful, vibrant, and ecologically and culturally diverse places on Earth. We are sustained, in more ways than one, by the mountains, deserts, rivers, streams, forests, farmlands, rangelands, coastline, and temperate climate that form our natural environment and characterize our great State.

These resources, and their natural beauty, enable our continued economic and cultural growth. They attract a wide array of businesses and workers who want to live here. They are a primary reason that California is: the eighth largest economy in the world; home to the most small businesses, Fortune 500 companies, and fastest-growing businesses in the United States; the national leader in global trade and direct investment; and tops in the United States in many economic sectors, including agriculture, biotech, clean energy, entertainment, high-tech, manufacturing, tourism, and more.

Accordingly, Californians of all backgrounds and political persuasions have supported policies and planning to protect our natural environment and the high quality of life it provides. The result is a decades-long, broad commitment to ensuring clean air and water, an efficient and productive use of energy and resources, a healthy workforce, and vital cities and towns. Our collective will to protect the environment is a valuable resource in itself, whose benefits enhance economic growth and prosperity in our state and help shape California's distinct identity.

SUCCESS STORY

THE CITY OF BENICIA CALIFORNIA

The City of Benicia

How can Government work to reduce GHG emissions in a manner that does not burden business with onerous regulations? The City of Benicia has found a solution. Benicia has budgeted $625,000 to incentivize businesses to make resource and management improvements to reduce energy, water, solid waste, recycling, and fuel costs. The program furnishes businesses a comprehensive energy assessment, and if the energy savings are great enough, can provide grants and loans to help with recommended improvements. As of November 2013 the program has assisted ten businesses for annual cumulative annual savings of nearly $140,000 while reducing annual GHG emissions by 135 metric tons.

With climate change threatening our resources, economy, and quality of life, California is squarely focused on addressing it and protecting our natural and built environments. Just as California has done dozens of times before on other environmental issues, it is leading on climate change, with an approach that will enable better, lasting economic growth and allow the California lifestyle to endure.

B. Foster Resilient Economic Growth

We are addressing climate change head on because we must, but the necessity of action should not imply lost opportunity or economic compromise. The supposition that the status quo, characterized by relatively inefficient use of finite fossil resources, represents a preferred or lower-cost energy system is a false one. The imperative of climate change and an unwavering commitment to meet the challenge through innovation will drive technology development and advance social progress. They provide clear signals that encourage businesses to grow and invest in ways that do not come at the expense of future generations, but instead, provide even more opportunity for growth in the future. Investments that allow us to do more with less and unlock the availability of clean, renewable energy only push out the boundary of our future potential.

The transition to a clean energy future presents us with a tremendous opportunity to continue economic growth. In particular, since the adoption of AB 32, California's clean energy companies have grown faster and shown greater resilience than the State's overall economy.[46] We have emerged as the national dominant player in both clean energy jobs and clean energy investment.[47, 48, 49] These jobs offer better-than-average wages and provide needed employment opportunities in the construction and manufacturing sectors.[50, 51, 52] California's policy approach to climate change is supporting continued growth in these sectors, and the good, high-paying jobs that it brings.

Through AB 32 and related policies, California has implemented a suite of policies that is reducing emissions by both reducing energy demand and cleaning up energy supply. Taken together, our efficiency and clean energy policies are reducing not only GHG emissions, but also energy costs for consumers. For example, while the State moves toward 33 percent renewable energy in its electricity supply mix, it continues to outpace the rest of the country on energy efficiency. The State's building and appliance energy efficiency standards have saved Californians $74 billion in energy costs since 1977. California has the fourth lowest per-capita energy-related GHG emissions in the country and produces twice as much economic value for every unit of electricity used. California households also pay the ninth lowest electricity bills in the country (see Figure 4).

46 Next 10, 2013. 2013 California Green Innovation Index, Figure 35, Employment Growth Relative to 2001, pp. 42, 51, 55. Available at *http://next10.org/2013innovation* and *www.greeninnovationindex.org*

47 U.S. Bureau of Labor Statistics, 2013. "Employment in Green Goods and Services – 2011," USDL-13-0476. Available at *www.bls.gov/ggs*

48 Thomson-Reuters, 2012. "National Venture Capital Association Yearbook."

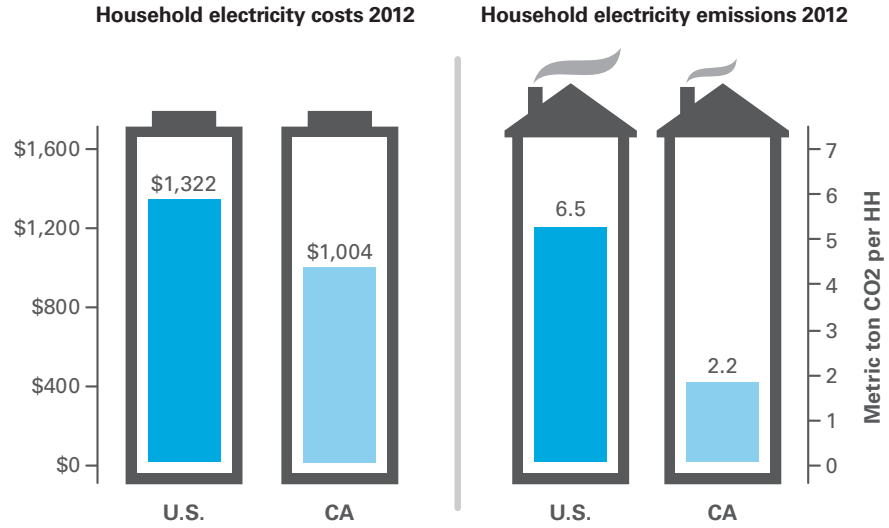
49 Pricewaterhouse Coopers, "National Venture Capital Association MoneyTree Report."

50 Brookings-Battelle, 2010. "Sizing the Clean Economy: A National and Regional Green Jobs Assessment."

51 Next 10, 2013. 2013 California Green Innovation Index, Figure 40, p. 46. Green Establishments Database, Data analysis: Collaborative Economics.

52 Collaborative Economics, 2012. "Seven Growth Sectors Driving California's Clean and Efficient Economy," May 2012. Available at *www.edf.org/sites/default/files/EDFSevenSectors-5.24.2012pdf.pdf*

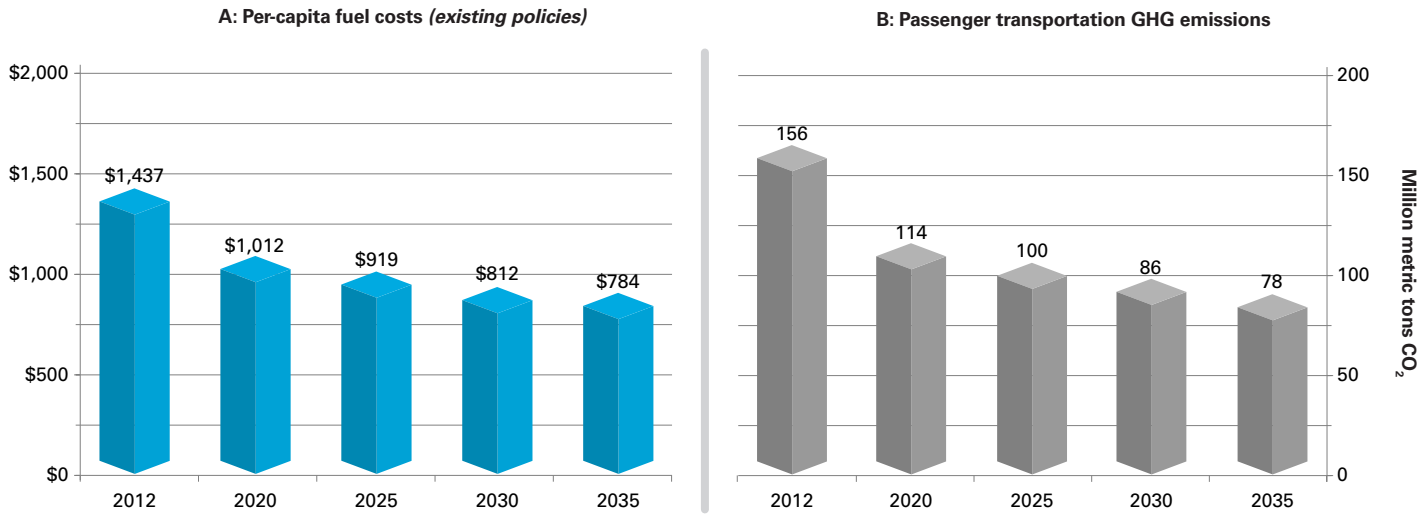
Figure 4: Average Household Expenditures on Electricity and Associated GHG Emissions in the United States and California[53]



Sources: U.S. Energy Information Administration [EIA] and ARB

The same holds true for the transportation sector. The results of California's collection of clean vehicles and fuels policies are dramatic reductions in GHG and criteria air pollution, technology innovation, and declining transportation costs. The combination of California's vehicle GHG and Zero Emission Vehicle (ZEV) standards and policies adopted under AB 32—including the Low Carbon Fuel Standard, SB 375, and Cap-and-Trade—will reduce per-capita fuel costs and GHG emissions from light-duty vehicles and fuel use by about 30 percent from current levels in 2020, and by about 50 percent in 2035 (see Figure 5). Additional measures to reduce emissions could further reduce fuel costs, as well.

Figure 5: (a) Per-Capita Fuel Costs and (b) Passenger Transportation GHG Emissions in California as a Result of the Existing Suite of California Climate Policies



53 California GHG emissions include imported electricity.

This is not to say that there are no costs associated with transitioning to clean technologies. Any technology or infrastructure change comes with initial costs. And pricing GHG emissions, as California's Cap-and-Trade Program does, inherently adds a cost at sources of pollution.

But many of the technologies needed to meet our current policies are already cost-competitive today, and prices continue to decline. In some parts of the country, new renewable power generation is competitive with new fossil generation, and in some cases, even competitive with existing fossil generation. For millions of households and businesses in California, adding rooftop solar is already reducing their energy costs. With attractive lease prices, electric vehicles are among the most affordable new cars on the market for consumers today. Multiple studies confirm that plug-in cars are already more affordable than conventional vehicles on a total cost of ownership basis.[54] And the cleaner alternatives to gasoline and diesel that are available on the market today either cost about the same as petroleum fuels (in the case of biodiesel, ethanol, and renewable gasoline and diesel), or cost far less than the petroleum fuels they replace (in the case of natural gas, renewable natural gas, or electricity).

As costs of these technologies continue to decline and additional energy efficiencies are achieved, energy costs for consumers will continue to fall, along with GHG emissions.
Avoided energy costs are pumped back into the economy elsewhere, boosting growth further.

Many more opportunities exist to capture additional efficiencies and productivity gains that will create new businesses and industries, save consumers money, and make many existing businesses and industries in California more competitive. Multiple studies show that businesses in the U.S. could collectively cut GHG emissions by more than one gigatonne (Gt) annually by 2020, representing more than 20 percent of current energy-related emissions, and generate several hundreds of billions of dollars in net savings.[55, 56] The National Academies found

54 For example, see: EPRI. 2013. Total Cost of Ownership Model for Current Plug-In Electric Vehicles. Electric Power Research Institute.

55 WWF and CDP. 2013. The 3% Solution. World Wildlife Fund and the Carbon Disclosure Project. *http://worldwildlife.org/projects/the-3-solution*.

56 McKinsey & Company. 2009. Unlocking Energy Efficiency in the U.S. Economy. McKinsey & Company. *www.mckinsey.com/client_service/electric_power_and_*

SUCCESS STORY

Anheuser-Busch InBev

Anheuser-Busch's Fairfield, California facility is covered by the Cap-and-Trade Program. Cap-and-Trade is designed to encourage energy efficiency and clean energy development. Anheuser-Busch is the world's largest operator of Bio-Energy Recovery Systems that turn the nutrients in wastewater from the brewing process into renewable biogas. The use of biogas at the Fairfield brewery accounts for 15 percent of on-site fuel needs. In addition, the Fairfield brewery has installed a large (1.5 MW) wind turbine on site and estimates about 11 percent of the plant's electricity is wind power. A planned second turbine will approximately double that supply. The turbines join a system which includes a 1.3 MW solar array. The company estimates the plant will get about 25 percent of its power from renewable sources with completion of the entire project. Over the next 20 years the shift will reduce greenhouse gas emissions by six million tons and save $2.5 million.

that U.S. manufacturing could reduce industrial energy usage by as much as 22 percent in 2020, using only technologies that yield at least a ten percent internal rate of return or a return that is greater than the company's cost of capital plus a risk premium.[57] And the Alliance Commission on National Energy Efficiency Policy has found that trillions of dollars of cost-effective energy efficiency potential is available in the United States, and that capturing it could double energy productivity by 2030, save households over $1,000 annually, add over one million jobs, and cut CO_2 emissions by one-third.[58]

Reducing GHG emissions is good business because it not only saves on energy costs, but also cuts maintenance costs, improves productivity and safety, and provides value as a hedge against future fluctuating energy prices.[59] It builds competitive, resilient businesses that are less exposed to risk from volatile energy prices and are better situated to provide lasting economic value and growth. And it diversifies energy supplies and reduces the costs that oil dependence imposes on our economy—up to half a trillion dollars per year across the United States in lost productivity and wealth transfer, alone.[60]

The Obama Administration has set a goal to double energy productivity in the United States by 2030. California is well on its way to achieve this goal as one of the most energy productive states in the country. Our commitment and approach to address climate change will continue to make our economy more efficient and productive; it will keep us ahead, while reducing emissions.

C. Strengthen the Natural Environment

In California and elsewhere, climate policy has primarily focused on reducing the energy-related GHG emissions from the built environment that account for over 85 percent of the GHG emissions in California and the United States. This includes all the buildings, cars, trucks, tractors, machines, and industrial operations that make our economy go. Accordingly, since AB 32 was passed, California has begun to build an effective framework for reducing energy-related emissions on an ongoing basis.

California has a number of policies and incentives in place to reduce emissions from agriculture, water management, and natural and working lands, as well. But additional research and policy development is needed to adequately and fairly incorporate the natural environment into an effective, lasting climate policy framework. California is committed to strengthening the role of the natural environment in climate policy. Continued work among agencies, researchers, stakeholders, and others is needed to further incorporate agriculture, natural, and working lands into the State's policy framework.

Moving forward, as energy-related emissions continue to decline in California and the developed world, the role of the natural environment in managing GHG emissions will only increase. Still, whatever its fraction of total GHG emissions, the importance of incorporating the natural environment into climate policy and planning outstrips its contribution to the State's GHG inventory. In addition to preserving California's lifestyle and economy, natural capital provided by our environment is crucial for providing safe and reliable water supplies, clean air, ecological habitat, and protection against climate change impacts. Strong and healthy coastlines, forests, waterways, marshlands, agricultural lands, and rangelands are crucial not only to support our agricultural and tourism-based economies, but also to reinforce and buffer our State from the

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natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy.

57 NAS. 2009. America's Energy Future: Technology and Transformation. National Academies Press. *www.nap.edu/catalog.php?record_id=12091*.

58 ASE. 2013. Energy 2030. Alliance to Save Energy. *www.ase.org/policy/energy2030*.

59 PwC. 2013. Less and be more: better for the bottom line and the environment. 10Minutes series on eco-efficiency. *www.pwc.com/en_US/us/10minutes/assets/pwc-10minutes-eco-efficiency.pdf*.

60 Greene. 2013. "Low Carbon Transportation: A Crucial Link to Economic and National Security." *www.arb.ca.gov/research/lectures/speakers/greene/greene.htm*.

increasing impacts of climate change, including drought, flood, and forest fires. Strengthening our natural environment makes it, and consequently our economy, more resilient to the impacts of climate change and protects our built environment.

Adequately accounting for the natural environment in our climate framework requires an integrated approach that values natural resources, not just as emission sources or sinks, but also for the other values they provide. It requires coordinating plans to reduce emission impacts from the natural environment with plans to strengthen it and prepare for climate change impacts. This is the approach California will take as we continue to build our climate policy framework. The approach will not only contribute emission reductions and build emission sinks necessary to manage climate change, but also strengthen the natural environment that drives our economy and supports our quality of life.

D. Improve Public Health and Social and Environmental Justice

The impact of climate change and California's policy approach to address it reaches beyond environmental protection and economic opportunity. If done appropriately, addressing climate change provides tremendous opportunity to improve the health and well-being of all of California's citizens and to help unravel many of the patterns of environmental, health, and social inequalities within our communities.

Cleaner and more efficient power plants, industrial facilities, cars and trucks, modernized freight systems, and reduced travel demand are already greatly reducing air pollution and cancer risks in California, particularly in environmental justice communities. Strengthening our natural environment, including those areas surrounding the most impacted urban and rural communities, will further improve public health.

Ongoing planning to create more sustainable communities in the State is providing expanded mobility options, including greater access to walking and biking facilities, increased access to employment and services, and more vibrant surroundings. Energy efficiency, green buildings, and other clean energy technologies and climate policies are creating more comfortable, safer homes and transportation options, and are saving families money. Efforts to improve industrial, manufacturing, and agricultural efficiency and productivity will strengthen these sectors and make the communities and jobs they support more resilient to national or global economic downturns and climate impacts. All of these aspects of California's climate policy approach bring economic, health, and other benefits to all of California's communities.

Yet, innovative public policy brings unknowns. As California continues to lead on climate change and pioneer new policy and technology strategies to avert the worst impacts of global warming, we must continue to monitor and assess the health and environmental justice impacts of our programs and policies, making changes when necessary to maximize benefits. Capturing the opportunities of climate policy to improve health and quality of life in all of California's communities is a critical aspect of our leadership and is building a successful and lasting climate policy framework. Delivering on those opportunities will serve to expand policy action beyond the State's borders.

E. Rely on Science and Foundational Research

California's environmental policy successes are built on a strong foundation in science. Successfully addressing climate change and planning to achieve targeted emission reductions over time similarly requires a dependence on foundational research.

Climate policy in California has been supported, and advanced, by our State's world-class research institutions, which have made California perhaps the most studied region in the world when it comes to GHG emissions and climate policy. As a result, we have a strong sense of the mix of technologies needed to reduce emissions through 2050, especially in the energy sector, and a valuable research apparatus to support ongoing policy planning and implementation.

A number of studies look to 2050 in California and provide a snapshot of the mix of technologies necessary to reduce energy-related emissions in California to 80 percent below 1990 levels by 2050.[61] They share many common conclusions, including the overarching conclusion that the 2050 emissions target is achievable, mostly with technologies that are commercially available today.

Together, they show that achieving the 2050 target will require energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and rapid market penetration of efficiency and clean energy technologies that requires significant efforts to deploy and scale markets for the cleanest technologies immediately. The studies agree that large efficiency

61 For example, see: Greenblatt, J., et al. 2011. California's Energy Future, The view to 2050: Summary report. California Council on Science and Technology (CCST). *www.ccst.us/publications/2011/2011energy.pdf*.
Williams, J. H., et al. 2011. "The Technology Path to Deep Greenhouse Gas Emissions cuts by 2050: The pivotal role of electricity." Science Express 335 (6064): 53–59. [E3] *www.sciencemag.org/content/335/6064/53*.
Wei, M., et al. 2013. "Deep carbon reductions in California require electrification and integration across economic sectors." Environmental Research Letters 7: 1–9. *http://iopscience.iop.org/1748-9326/8/1/014038/*.
[LBNL-1] Wei, M., et al. 2012. "California's Carbon Challenge (CCC): Scenarios for Achieving 80% Emissions Reduction in 2050." Lawrence Berkeley National Laboratory. October 31. *http://rael.berkeley.edu/sites/default/files/California%20Carbon%20Challenge%20Report%20Nov%201_2012.pdf*. [LBNL-2]
Jacobson, M. Z., et al. 2013. Evaluating the technical and economic feasibility of repowering California for all purposes with wind, water and sunlight. *www.stanford.edu/group/efmh/jacobson/Articles/I/CaliforniaWWS.pdf*. [Stanford]
McCollum, D., et al. 2012. "Deep greenhouse gas reduction scenarios for California – Strategic implications from the CA-TIMES energy-economic systems model." Energy Strategy Reviews 1(1):19–32. *http://www.sciencedirect.com/science/article/pii/S2211467X11000083*. [UCD-1]
Yang, et al. 2009. "Meeting an 80% reduction in greenhouse gas emissions from transportation by 2050: A case study in California." Transportation Research Part D 14. *www.internationaltransportforum.org/pub/pdf/10FP03.pdf*. [UCD-2]

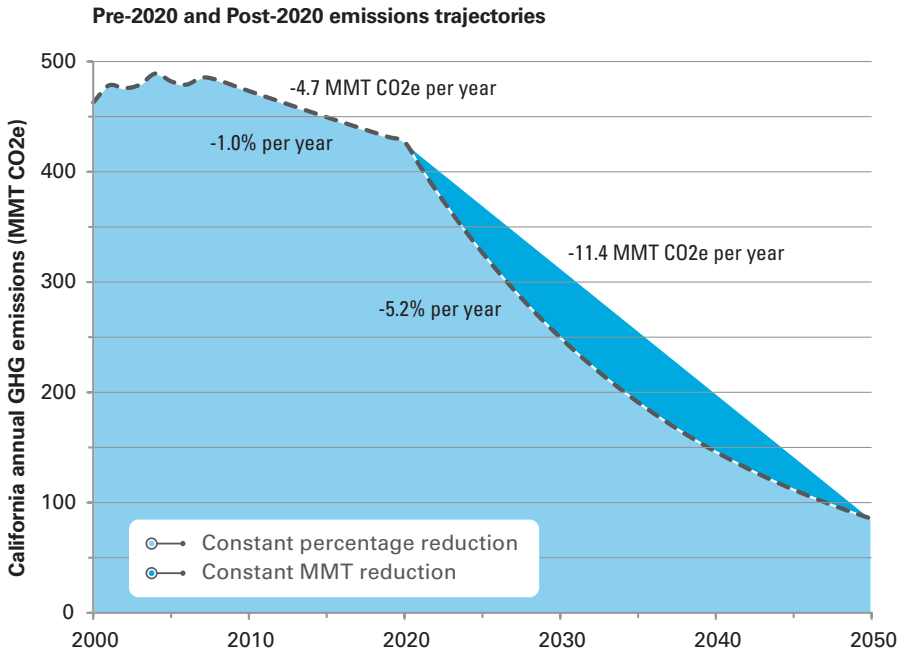
improvements can be achieved in transportation, buildings, and industry; that the electricity sector will have to be essentially zero carbon; and that electricity or hydrogen will have to power much of the transportation sector, including almost all passenger vehicles, and that near-zero carbon biofuels will have to power most other vehicles. They recognize a need for the natural environment to play an important role, providing carbon sinks to offset emissions, and a need to integrate and coordinate policy across a number of objectives and planning processes.

The studies vary in several important assumptions, however, which offer opportunities to pursue additional emission reductions or select alternative policy and technology paths forward—depending on population and economic growth in the State, technology and market development, and changing activity and behavior patterns. California will need to monitor the market and technology progress alongside emissions, and continue to rely on strong supporting research as it builds on its climate policy framework. One thing is clear; many prominent California scientists and economists support a mid-term target to meet California's long term climate goals.[62]

F. Charting a Path to 2050

Achieving the low-carbon future described in these studies will require that the pace of GHG emission reductions in California accelerate significantly. Emissions from 2020 to 2050 will have to decline several times faster than the rate needed to reach the 2020 emissions limit (Figure 6).

Figure 6: Framing the Path to 2050



Ultimately, climate change is affected by cumulative emissions. As described in Chapter II, the world must keep within scientifically determined "carbon budgets" to achieve climate stabilization. Accordingly, different paths to the same 2050 emissions levels will result in different climate impacts. Tackling global warming requires us to reduce and minimize total emissions, not just reach stated targets.

62 An Open Letter on Climate Change from California Climate Scientist and Economists: *www.arb.ca.gov/lists/com-attach/10-proposed-sp-ws-AHUFYFIgVCkEcIQw.pdf*

Appropriate action on climate change requires a continuum of action to capture cost-effective emission reductions opportunities wherever possible, on an ongoing basis. We need to meet strict, science-based targets not just in 2020 and 2050, but at every point in between, as well. California's leadership will be defined not just by its emissions level in 2050, but also by the pathway it takes to get there.

As described in Chapter IV, California will develop a mid-term target to frame the next suite of emission reduction measures and ensure continued progress toward scientifically based targets. This target should be consistent with the level of reduction needed in the developed world to stabilize warming at 2°C (3.6°F) and align with targets and commitments elsewhere. The European Union has adopted an emissions reduction target of 40 percent below 1990 levels by 2030. The United Kingdom has committed to reduce its emissions by 50 percent below 1990 levels within the 2022–2027 timeframe, and Germany has set its own 2030 emissions target of 55 percent below 1990 levels. The United States, in support of the Copenhagen Accord, pledged emission reductions of 42 percent below 2005 levels in 2030 (which, for California, translates to 35 percent below 1990 levels).

This level of reduction is achievable in California. In fact, if California realizes the expected benefits of existing policy goals (such as 12,000 megawatts [MW] of renewable distributed generation by 2020, net zero energy homes after 2020, existing building retrofits under AB 758, and others) it could reduce emissions by 2030 to levels squarely in line with those needed in the developed world and to stay on track to reduce emissions to 80 percent below 1990 levels by 2050.[63] Additional measures, including locally driven measures and those necessary to meet federal air quality standards in 2032, could lead to even greater emission reductions.

Setting a strong mid-term target that aligns with scientifically established needs is an important next step in California's climate policy leadership. Such a target will provide greater levels of market certainty in the near term, while allowing flexibility to review and adjust our course based on future technology and market conditions. Planning and effectively implementing policies to achieve a mid-term target in a manner that advances economic growth, public and environmental health, and quality of life in all of the State's communities will further demonstrate California's successful policy approach and create an enviable framework that others will look to follow.

63 Greenblatt, J. 2013. Estimating Policy-Driven Greenhouse Gas Emissions Trajectories in California: The California Greenhouse Gas Inventory Spreadsheet (GHGIS) Model. Lawrence Berkeley National Laboratory. *http://eetd.lbl.gov/publications/estimating-policy-driven-greenhouse-g*

IV. Accomplishments and Next Steps

California must continue to build on the framework established in the initial Scoping Plan as we look toward meeting our long-term climate goal of GHG emissions of 80 percent below 1990 levels by 2050. A mid-term statewide emission limit will ensure that the State stays on course to meet our long-term goal and continues the success it has achieved thus far in reducing emissions. The mid-term statewide limit will help frame the additional suite of policy measures, planning efforts, and investments in clean technologies that California will need to continue to drive down emissions and grow a cleaner, more sustainable economy.

This chapter provides a discussion of GHG emission reduction mitigation strategies for each of California's major economic sectors. It identifies the activities, policies, and other accomplishments, primarily over the last five years, that address climate change to reduce GHG emissions to meet the 2020 statewide limit. It also identifies longer-term strategies that the State must undertake to continue to reduce GHG emissions into the future to ultimately meet our long-term climate goal.

Each major sector highlighted in this chapter must play a role in supporting the statewide effort to continue to reduce emissions. Planning must begin now in order to implement our longer-term strategies. Specific recommendations for steering the State down this path are summarized, by sector, at the end of this chapter. As the statewide mid-term target is developed, sector targets will also be developed that reflect the opportunities for reductions that can be achieved through existing and new measures, actions, and investments.

A. Key Economic Sectors

The initial Scoping Plan recommended specific GHG emission reduction measures in nine major economic sectors to better define, organize, and determine control strategies for each. In this Update, six key areas of the State's economy were identified (energy, transportation, agriculture, water, waste management, and natural and working lands), along with short-lived climate pollutants, green buildings, and the Cap-and-Trade Program. The subsections below describe our progress in reducing GHG emissions and what will be required to better evaluate GHG emission reduction actions within California's broad economy to meet the State's more expansive longer-term emission reduction goals.

These key areas have overlapping and complementary interests that will require careful coordination in the State's future policies and strategies. The areas were chosen based on their ability to address concerns that underlie all sectors of the economy. As such, each focus area is not contained to a single economic sector, but has far-reaching impacts within many sectors. For example, much of the transportation sector will need to be electrified in the future. This creates demand for more electrical generation, but also provides an opportunity to take advantage of broader systems efficiencies as sectors interact in new ways.

Another example is the interaction between water delivery and energy use in California. Since water delivery is very energy-intensive, implementing programs that strongly support water conservation can reduce GHG emissions in the electricity sector by reducing the need for electricity to move, treat, and heat water. Water conservation is also critical to making the State's water supply more reliable and drought resistant. Producing electricity requires large volumes of water. Promoting a system that maximizes appropriate cooling technologies (e.g., reclaimed water and dry cooling towers), energy efficiency, and conservation can greatly reduce water demands and make those water savings available for agriculture and other essential needs. The way that communities and infrastructure are designed and built can significantly reduce California's impact on natural lands, minimize vehicle miles traveled, reduce water needs, and provide many other benefits for the State as a whole.

1. Energy

California's energy sector includes a complex system of electricity and natural gas production, transmission and distribution, utility service operations, and consumption by diverse end users—including residential, commercial, and industrial activities. Energy is a common thread that runs through all sectors of California's economy. It's also one of the State's largest contributors to GHG emissions. Presently, about 50 percent of the State's total GHG emissions are associated with the energy sector; therefore, efforts to reduce energy-related emissions are a key component of the Scoping Plan. Additionally, energy-sector emission reduction efforts will become increasingly important as more economic activities such as transportation and freight movement are electrified.

Reducing energy-sector emissions to near zero over the long-term will require wholesale changes to the State's current electricity and natural gas systems. The energy sector will generally need to adapt to a system consisting of near-zero carbon buildings (refer to Section 8 of this chapter for more discussion of zero net carbon buildings), highly efficient businesses and industry, low-carbon electricity generation, sustainable bioenergy systems, smarter and localized generation, a flexible and modernized transmission and distribution system, more compact land use, and electricity substitutes for fuels currently used for transportation, space heating, and industrial processes.

Achieving these emission reduction goals will require that a number of important administrative, financial, and technological changes are undertaken to guide energy investments and planning toward the most appropriate combination of conservation, efficiency, and clean-energy technologies to decarbonize the State's energy systems at the lowest cost.

Electricity and Natural Gas

California has made remarkable progress in developing and implementing new policies and strategies to reduce GHG emissions within the State's energy sector. California has a track record of decades of rigorously evaluated, cost-effective energy efficiency improvements across all sectors of the economy. The initial Scoping Plan continued these priorities by advancing a host of innovative and aggressive building, appliance, electronic, and water-efficiency standards that are certain to maintain California's leadership in this area.

An example of California's leadership in the energy sector is SB 1368 (Perata, Chapter 598, Statutes of 2006), which created the nation's first emission performance standard for centralized power generation. SB 1368 prevents the State's electric utilities from making long-term investments in high GHG-emitting baseload power plants. The U.S. EPA is following California's lead by proposing a GHG emission performance standard for the nation's power plants.

Consistent with the State's loading order,[64] the California Energy Commission (CEC) and California Public Utilities Commission (CPUC) have adopted several programs and regulations since 2008 that are driving efforts to reduce electricity-sector GHG emissions. Many of these programs are implemented at the local electric utility level. Below is a discussion of efforts being undertaken to reduce GHG emissions from the energy sector in accordance with the State's loading order.

Energy Efficiency

A variety of appliance (including electronics) and building energy efficiency programs and initiatives represent the State's top priority in reducing the need to develop new energy resources to meet California's electricity and natural gas demand. The CEC continues to provide a leadership role in developing and adopting new appliance and building efficiency standards for the State. Building efficiency standards were updated in 2013 and are now 25 percent more efficient for residential construction and 30 percent more efficient for non-residential construction.[65] The CEC also adopted aggressive energy efficiency standards for televisions in 2009, and first-in-the-nation energy efficiency standards for battery chargers in 2012.[66]

The CEC is currently considering additional appliance categories to cover under its appliance energy efficiency standards. Those under consideration include consumer electronics, lighting, water appliances, and several others. Future updates to these standards and collaborative work with the U.S. Department of Energy should focus on realizing both cost-effective energy savings and incorporating features that can assist in grid resilience and responsiveness.

In addition to the State's energy efficiency Standards, California's investor-owned utilities (IOUs) regulated by the CPUC have a long history of implementing energy efficiency programs that target both residential and non-residential sectors. The State's self-regulated publicly owned utilities (POUs) also have energy efficiency programs. The POU programs vary significantly between the individual utilities, but in some cases can be more aggressive than the IOU goals.

The CPUC's evaluation activities have focused on verifying utility savings claims and improving savings estimates via field-based research. Findings and recommendations from these studies have been critical to continued improvement of energy efficiency programs in the State. The CPUC has recently opened a new rulemaking in which it has signaled its intent to provide grid planners and efficiency markets with greater certainty regarding the State's commitment to these programs. Similar progress and initiatives should be made in all POU territories.

Funding from the California Clean Energy Jobs Act (Proposition 39), approved by California voters in November 2012 and subsequently refined through Senate Bill 73 (Skinner, Chapter 29, Statutes of 2013), will provide a significant source of new revenue (an estimated $2.5 billion over five years) to support energy efficiency and clean energy projects in California's public schools (K–12) and community colleges.

At the local government level, several communities have created property-assessed clean energy financing districts (PACE programs) that allow residential and commercial property owners to finance renewable on-site generation and energy efficiency improvements through voluntary property tax assessments.

Governor Brown took specific action in 2012 to improve the energy efficiency of state-owned buildings through Executive Order B-18-12, which directs State agencies to reduce their grid-based energy purchases by at least 20 percent by 2018. This Executive Order also directs State agencies to reduce the GHG emissions associated with the operating functions of their

64 The "loading order" is California's preferred sequence for meeting electricity demands: energy efficiency and demand response first; renewable resources second; and clean and efficient natural gas-fired power plants third.

65 Computed from California Energy Demand, 2012–2022 Final Forecast, June 2012, Form 2.2 on Committed Energy Impacts.

66 CEC. 2013. California Energy Commission 2012 Accomplishments. *www.energy.ca.gov/releases/2013_releases/2012_Accomplishments.pdf*.

SUCCESS STORY

Kaiser Permanente

Between 2010 and 2011, Kaiser Permanente installed solar panels that increased its on-site renewable generation capacity to 11 megawatts at 12 facilities across California, creating one of the largest health care solar installations in the country. The panels generate clean, renewable energy for Kaiser Permanente hospitals and buildings, avoiding approximately 7,600 metric tons of CO_2 emissions annually since 2012. Kaiser Permanente also deployed four megawatts of natural gas-powered fuel cell generation capacity, thus avoiding approximately 5,700 metric tons of CO_2 emissions in 2012, while reducing the organization's reliance on the public electric grid and helping to diversify energy sources.

buildings by ten percent by 2015, and 20 percent by 2020.[67] State agencies have been able to achieve a four percent reduction in total energy use despite a 12 percent increase in building space since 2003.

Fifty-five percent of existing residential buildings and 40 percent of non-residential buildings were constructed before California's building energy efficiency standards were established. California's legislature recognized the opportunity and importance of upgrading existing residential and commercial buildings and passed Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009), which requires the CEC to develop and implement a comprehensive energy efficiency plan for all of California's existing buildings. The CEC is currently drafting an AB 758 Action Plan to accomplish the following:

- Improve code compliance rates with Title 24 Building Standards for existing building upgrade projects.
- Develop energy disclosure approaches and programs that build on existing efforts and expand the types of applicable buildings, including State buildings in alignment with Governor Brown's Executive Order B-18-12.
- Collaborate with the real estate and property management industries to craft aggressive, but practical, solutions to achieve efficiency upgrades in existing buildings.
- Enhance usability of Title 24 Building Standards as applied to additions and alterations of existing buil dings.

Achieving the State's zero net energy (ZNE) building goals is an important effort under way to assist with achieving climate targets. In 2008, the CPUC set forth ZNE goals in its long-term Energy Efficiency Strategic Plan and implementation roadmap for the Big Bold Energy Efficiency Strategies, which was later updated in 2011. The CPUC's Big Bold Energy Efficiency Strategies set policy goals to achieve ZNE in all new residential buildings by 2020, and all new commercial buildings by 2030.

The CEC has made progress toward achieving the State's ZNE goals for new residential and new commercial buildings through triennial updates to the State's building energy efficiency standards.

67 Executive Order B-18-12, issued on April 25, 2012. See *http://gov.ca.gov/news.php?id=17508.*

Working with the CPUC, the CEC adopted a definition for ZNE code-compliant buildings that was published in the 2013 Integrated Energy Policy Report. Building on this effort, ARB and CEC should analyze[68] zero and near-zero GHG alternatives for heating, cooking, and commercial energy use and assess the potential economic and technological barriers to switching to these alternatives. ARB is committed to building upon the recent policies and goals adopted by the CPUC and CEC and supporting the development of statewide programs, such that all new residential and commercial buildings are zero net energy by 2020 and 2030, respectively.

Recent efficiency initiatives that overlap across agencies, such as American Recovery and Reinvestment Act of 2009 (ARRA)-funded whole-house upgrades and Proposition 39 schools-focused activities, have revealed inconsistencies in the accounting and evaluation methods for estimating, verifying, and valuing energy efficiency savings across State agencies. These differences may be driven by the historic policy drivers for the energy efficiency activities. Since the methods of measuring, verifying, and valuing energy efficiency can impact the scope of future efficiency programs and the resulting GHG savings, efforts should be undertaken to improve the efficacy of these efforts by emphasizing consistency, transparency, credibility, and timeliness.

Demand Response

Demand response is also at the top of California's loading order for meeting the State's electricity demand. Demand response is provided primarily by utilities or third-party demand-response providers (DRPs), also known as aggregators, through programs or contracts that are supported by $1 billion in ratepayer funding (over three years). Demand response has traditionally been used to reduce peak demand and there is currently approximately 2,000 MW of demand-response capacity in IOU territories. Some programs are used to mitigate emergency situations, while others are used to address economic conditions, such as high wholesale energy prices

The CPUC recently initiated a new rulemaking[69] for demand response for the purpose of enhancing its role in meeting the State's resource planning needs and operational requirements. Specifically, the rulemaking states that demand response needs to improve its reliability and usefulness as the State's grid needs continue to evolve. For example, demand-response resources are not bid into California Independent System Operator (CAISO) wholesale energy markets, thereby reducing their visibility and dispatchability to CAISO's grid operators. The CPUC's rulemaking and its concurrent efforts to approve "direct participation" rules in 2014 (also known as Rule 24) are the first steps of many that will lead to the bidding of demand response resources into wholesale markets.

The rulemaking also recognizes that demand response has potential value as a flexible capacity resource for renewable integration (through increasing or decreasing demand), a balancing energy and ancillary service resource, and an alternative to transmission upgrades. Demand response as a renewable integration resource carries significant implications for GHG reduction goals. Renewable resources such as wind and solar are variable, and thus grid operators must rely on load-following resources to maintain grid stability. Those load-following resources are typically quick-start fossil-fuel generation plants. If demand response can provide the needed reliability for variable renewable resources, the State will have less need for quick-start fossil-fuel generation plants.

However, existing demand response resources do not yet have the speed, flexibility, or reliability to achieve this potential. One purpose of the CPUC rulemaking is to determine, in close collaboration with CAISO, the specific qualities demand response resources will need in order to address these new grid needs. Once these qualities have been set, market participants can then be directed to provide the "next generation" of demand-response resources through appropriate procurement mechanisms. The CAISO's Flexibility Resource Adequacy Criteria and Must-Offer

68 The CEC is required by Title 24 to use a lifecycle cost-effectiveness analysis methodology.

69 R.13-09-011, issued on September 25, 2013: *http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M077/K151/77151993.PDF*

Obligation (FRACMOO) stakeholder process and its anticipated demand response Standard Capacity Product stakeholder process are key CAISO initiatives in setting specific design and operational details for future demand response resources.

While development of DR as a renewable integration resource is a critical next step for California, the CPUC rulemaking also signals the importance of refining demand-response resources that cannot be bid into CAISO markets but are beneficial to the State's goals of reducing energy consumption during peak hours. These resources, referred to as load-modifying demand response, can reduce California's demand curve over time through strategies such as time-of-use rates and permanent load-shifting programs. The impact of these programs could potentially reduce the need for gas-fired generation resources in future planning processes. Additionally, the rulemaking will be exploring how demand response can be better coupled with other demand-side resources such as energy efficiency and distributed generation, so that retail customers see all their options and make well-informed decisions, thereby expanding demand-side resources collectively.

Renewable Energy

In 2011, the Legislature passed and Governor Brown signed a bill creating the nation's most aggressive renewables portfolio standard (RPS) program. The program requires California's investor-owned and publicly owned electric utilities, as well as all other retail sellers of electricity, to serve 33 percent of their customers' electricity needs with clean renewable energy by 2020. As part of his Clean Energy Jobs Plan, Governor Brown set an aggressive target of adding 8,000 MW of centralized, large-scale renewable facilities (of which 3,900 MW has come online since 2010) and 12,000 MW of distributed renewable generation by 2020. Of the 12,000 MW distributed renewable generation goal, 4,400 MW has already come online.

California has made substantial progress in developing new renewable resources to support the RPS and the governor's goals. The large investor-owned utilities report that they have met the 20 percent RPS goal for 2011–2013, are on track to meet the requirement of 25 percent renewables by 2016, and are well-positioned to meet the 33 percent target by 2020. The publicly-owned utilities have also contributed to meeting these targets and are progressing about as fast, and in some cases faster, than the investor-owned utilities.

Approximately 2,000 MW of new renewable capacity came online in 2012;[70] 1,600 MW of which is wind generation. Another 3,300 MW of renewable capacity is estimated to have come online statewide before the end of 2013. A total of 3,500 MW of solar (thermal and photovoltaic, or PV) and 5,700 MW of wind has been installed to date. California is now the nation's second largest producer of wind power.[71]

California leads the nation in the amount of solar PV capacity.[72] In 2012, California became the first state to install more than 1,000 MW of new solar capacity in a single year, from a combination of utility-scale projects and customer installations.[73] In 2013, the State added over 2,600 MW of solar PV; 2,300 MW from wholesale solar PV and 300 MW from self-generation PV. Solar PV programs[74] codified by Senate Bill 1 in 2006 (SB 1, Murray, Chapter 132) are driving much of the self-generation installation in California. SB 1 set a target for 3,000 MW of self-generation solar,

70 California Public Utilities Commission. 2012. Renewables Portfolio Standard Quarterly Report, 3rd and 4th Quarter 2012. *www.cpuc.ca.gov/NR/rdonlyres/2BC2751B-4507-4A38-98F5-F26748FE6A95/0/2012_Q3_Q4RPSReportFINAL.pdf*

71 Wiser, Ryan, and Mark Bolinger. 2012. 2011 Wind Technologies Market Report. Lawrence Berkeley National Laboratories. U.S. Department of Energy. DOE/GO-102012-3472. August.

72 Dutzik, Tony, and Rob Sargent. 2013. Lighting the Way: What We Can Learn From America's Top 12 Solar States. Environment America Research and Policy Center. July. *www.environmentamericacenter.org/sites/environment/files/reports/Lighting_the_way_EnvAM_scrn.pdf*

73 Marshall, J. 2013. California Still Tops in Renewable Energy Rankings. *www.pgecurrents.com/2013/08/22/california-still-tops-in-renewable-energy-rankings/*. Accessed August 23, 2013.

74 California's solar PV programs include the CPUC's California Solar Initiative, the Energy Commission's New Solar Homes Partnership, and publicly owned utility solar incentive programs.

including solar water heating, by 2017, of which 1,570 MW have been installed. Additionally, about 300 MW were installed prior to SB 1 as result of the Emerging Renewable Program, the Self Generation Incentive Program, and POU solar incentive programs. In total, about 1,900 MW of self-generation solar was installed in California by the end of 2013.

Energy Storage

While taking steps to minimize integration needs, the State must also advance energy storage technologies to help integrate increasing amounts of renewable resources. An energy storage device is a technology capable of absorbing energy, storing it for a period of time, and dispatching the energy as needed. Energy storage devices can store energy during times of low demand or over-generation and can then provide energy stored back into the grid during times of peak demand or when the grid is stressed.

Storage technologies can be applied on transmission and distribution systems and can help maintain a reliable and efficient transmission grid. Storage can also provide load-following capabilities to manage frequent and wide variations in solar and wind energy due to their fast ramp rates (megawatts of power delivered per minute). Storage can also complement demand response programs. In October 2013, the CPUC adopted an energy storage procurement framework and design program which requires the investor-owned utilities to procure 1,325 MW of energy storage by 2024.[75]

Combined Heat and Power

Combined heat and power systems (CHP), also referred to as cogeneration, generate on-site electricity and useful thermal energy in a single integrated system. Combined heat and power systems are typically used in industrial, commercial, and institutional applications where both electricity and steam are required. Governor Brown set a goal for 6,500 MW of additional CHP capacity by 2030 as part of his Clean Energy Jobs Plan. This goal builds upon the Scoping Plan's goal for emission reductions equivalent to 4,000 MW of new CHP generation by 2020.

Through the implementation of the 2007 Waste Heat and Carbon Emissions Reduction Act (also known as AB 1613, Blakeslee, Chapter 713, Statues of 2007), the CEC and CPUC have taken steps to create efficiency guidelines and market pricing incentives for small (<20 MW) CHP system owners. The CPUC also adopted the CHP "Settlement Agreement" in 2010,

75 CPUC. Decision Adopting Energy Storage Procurement Framework and Design Program. October 17, 2013. *http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M078/K912/78912194.PDF*.

SUCCESS STORY

California's electric grid is becoming more efficient through improved communications and control software that allow operators to check energy flow every few seconds and more accurately balance supply and demand. This also improves the ability of California grid operators to bring more energy from renewable sources into the state's electricity mix. Other in-building "smart" technology developments allow for more efficient energy usage and for real-time communication between consumers, their appliances, and electricity suppliers. A study by the Pacific Northwest National Laboratory estimated that these "smart grid" improvements can reduce GHG emissions from electricity generation by as much as 12 percent by 2030.

which created a new CHP program requiring that California's three largest investor-owned electric utilities procure a minimum of 3,000 MW of CHP capacity until 2015 and reduce greenhouse gas emissions by 4.8 $MMTCO_2e$.

Despite these policy actions and incentives for CHP, significant installation barriers for CHP systems still remain and very few new CHP systems have been installed since the initial Scoping Plan was released. Indeed, due to older system retirements, the State's overall CHP capacity may be lower now than it was in 2008. ARB is committed to working with the CPUC, CEC, and CAISO to assess existing barriers to expanding the installation of CHP systems and propose solutions that help achieve climate goals. A future CHP measure could establish requirements for new or upgraded efficient CHP systems.

Industry

In the initial Scoping Plan, the industry sector was discussed in a separate sector; however, in this Update it has been included within the energy-sector discussion because its GHG emissions are primarily due to energy use.

California industry includes a broad and diverse range of sources, including cement plants, refineries, power plants, glass manufacturers, and oil and gas production facilities. Industrial sources play a significant role in the State's vast economy and accounted for about 20 percent of California's total GHG emissions.

Most emission reductions from industry will be realized through California's Cap-and-Trade Program, which includes large industrial sources (i.e., sources emitting more than 25,000 $MTCO_2e$ per year). (See Section 9 of this chapter for a discussion of the Cap-and-Trade Program.) As with other activities covered by the Cap-and-Trade Regulation, ARB also assessed the potential for direct regulation measures that could be implemented at these facilities. In addition, fugitive emissions from industrial facilities (primarily methane emissions) are not part of the Cap-and-Trade Program. Therefore, direct regulations were also considered for industrial sources with significant fugitive GHG emissions—oil and gas extraction, natural gas transmission, and refineries.

Carbon capture and sequestration (CCS) is another option to reduce emissions from electricity generation and industrial emitters. ARB is currently working with researchers from the Lawrence Berkeley National Laboratory (LBNL) to evaluate existing quantification methodologies related to the sequestration portion of CCS in the context of California geological and regulatory considerations. ARB will continue to work with the Division of Oil, Gas & Geothermal Resources (DOGGR), CEC, and CPUC for future development of a quantification methodology for California GHG emissions sources.

In 2010, ARB approved the energy efficiency assessment regulation requiring California's largest industrial facilities to conduct a one-time assessment of the facility's fuel and energy consumption and emissions of GHGs, criteria pollutants, and toxic air contaminants. The assessments were to include the identification of potential energy efficiency improvement projects. ARB subsequently received assessment reports from 43 industrial facilities covering five industrial sectors: refinery, cement, hydrogen production, power generation, and oil and gas/mineral production. ARB is currently developing public reports for each industrial sector, summarizing the information provided by the facilities. ARB will use these findings to identify the best approaches to secure energy efficiency improvements and the associated emission reductions at California's largest facilities.

Regarding fugitive emissions, ARB undertook a survey of the oil and gas extraction sector, on items such as compressor seals, storage tanks, valves, flanges, and connectors, to improve the emission inventory. The key findings of this survey are influencing ARB's approach to developing a new measure in 2014 to reduce fugitive GHG emissions from these operations.

Current data indicate that methane emissions in California may be undercounted and that one potential source of these emissions is the natural gas transmission and distribution system. Based on a 2008 survey, the vast majority of the GHG emissions from this sector are expected to come from distribution pipeline leaks. Field measurements of fugitive emissions from natural gas distribution pipelines in California are currently being conducted to update the emission factors for this sector. The field study is expected to be completed by 2015. ARB will use the study results to determine the cost-effectiveness of developing a regulation to reduce fugitive GHG emissions from these operations.

Methane has historically been exempt from the local air districts' volatile organic compound (VOC) regulations, such as refinery leak detection and repair regulations, because it has very low photochemical reactivity and, thus, does not contribute significantly to smog formation. However, because methane is a powerful GHG and short-lived climate pollutant, ARB is working with local air district staff to determine the benefits of incorporating amendments to their existing leak detection and repair rules to include methane leaks from refineries and other industrial sources with a potential for fugitive methane emissions.[76]

Oil and Natural Gas Production

California has a significant oil and natural gas industry. Currently, our existing rules (LCFS, Cap-and-Trade and others) and proposed new measures, such as for hydraulic fracturing (fracking), oil and gas production, and other short-lived climate pollutants measures, will lead to best-in-industry practices to minimize GHG, criteria and toxic pollutant emissions associated with the production and refining of oil and gas.

Maintaining Momentum

California will be unable to achieve the needed GHG emissions within the energy sector by simply continuing or modestly expanding upon current energy conservation, efficiency, and generation decarbonizing program efforts. In addition, no single agency or entity has complete responsibility for the energy sector. As previously noted, a reworked and comprehensive State program will be required that addresses all affected energy entities and is specifically designed to ensure that the proposed emission reductions are achieved.

For example, in addition to calling for more localized generation and smart grid technologies, the energy sector should support "smarter generation." This includes advanced energy technologies and distributed generation, as well as regional grid management to allow for pooling of diverse resources. Planning for regional (west-wide) grid management is occurring through the Energy Imbalance Market (EIM), led by CAISO. It allows California to use a regional approach to increase grid reliability by allowing the State's energy system to pull from a more diverse set of resources to meet demand and renewable integration needs.

At the electricity distribution level, actions to expedite the deployment of small-scale storage systems, as well as microgrid and "smart-grid" technologies, are essential to maximize renewable and distributed resource integration. Strengthening and expediting California's policies for ZNE homes and businesses and maximizing energy conservation and demand-response participation in the consumer electricity market should also be a priority. The role and functions of utilities may need to evolve as California increasingly shifts toward more renewable and distributed energy integration.

The State will need a comprehensive and aggressive (but flexible) program to drive energy utilities toward providing zero and near-zero GHG energy resources. At the same time, the State will need to ensure that new or expanded economic development activities are designed to incorporate the most advanced energy-efficient technologies and energy-conserving practices.

76 In addition, CEC is mandated by AB 1257 (Bocanegra, Chapter 749, Statutes of 2013) to identify strategies for evaluating the lifecycle GHG emissions from the natural gas sector every four years.

State agencies should collaborate toward developing a comprehensive and enforceable GHG emission reduction program for the State's electric and energy utilities. The CEC, CPUC, and ARB will all have a role in developing and implementing the most technologically appropriate and cost-effective suite of strategies to achieve the State's emission reduction goals.

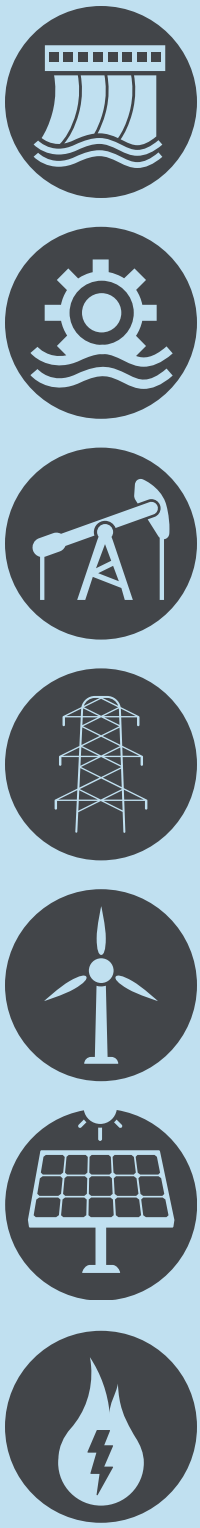
The program should maintain consistency with the State's broader energy policies, such as those articulated in the loading order and the initial Scoping Plan, and be designed to further advance key State energy programs and needs such as energy efficiency and demand-response efforts, renewable energy development, energy storage systems, smart-grid and microgrid deployment, and distribution and transmission system upgrades and expansion.

The program should contain monitoring mechanisms to ensure reasonable progress is being made in achieving emission reduction goals and broader energy policies. The program should include mid-term targets (including a GHG emission target and other targets that support meeting broader energy policies) designed to spur and gauge progress toward meeting a final 2050 GHG emission target and broader energy policies. The program should be established through a process which includes extensive stakeholder and public input.

In addition to facilitating the creation of the comprehensive emission reduction program, the State's energy agencies should pursue a series of key proceedings to further advance energy efficiency and conservation programs that hold great potential for reducing GHG emissions within the energy sector.

Several key actions are summarized below to drive the State toward developing and deploying the most appropriate market, resource, technology, and design options to achieve longer-term GHG emission reductions within the energy sector.

Key Recommended Actions for the Energy Sector



State agencies will develop comprehensive and enforceable GHG emission reduction requirements for the State's electric and energy utilities to achieve near-zero GHG emissions by 2050. Program development to be completed by end of 2016, and incorporate the following principles:

- Thoroughly account for the carbon intensity and air quality impacts of various energy resources, generation technologies, and associated fuels.
- Maximize local and regional benefits of energy facilities.
- Minimize emissions of criteria and toxic air pollutants.
- Avoid disproportionate impacts to disadvantaged communities.
- An enforceable program for all energy and electricity service providers.
- Recordkeeping and reporting mechanisms to monitor and enforce the GHG emission reduction requirements.

State's energy agencies pursue a series of key proceedings, including the following:

- Develop criteria and rules for flexible demand response resources to participate in wholesale markets and integrate variable renewable resources, reducing the need for new flexible fossil generation.
- Expand participation of regional balancing authorities in the CAISO Energy Imbalance Market and other potential methods of balancing authority cooperation, which provide low-cost, low-risk means of achieving real-time operational efficiency and flexibility needed for greater penetration of variable renewable resources, while ensuring support for greenhouse gas emission reduction programs.
- Through the AB 758 process, CEC will develop a plan to encourage energy assessments—particularly when done at the time a building or unit is sold or by a predetermined date—as well as energy use disclosure requirements.
- Enhance energy efficiency and demand response programs, including development of education/outreach programs, and develop robust methodologies to monitor and evaluate the effectiveness of these programs. Methodologies developed by end of 2015 with the enhanced program proceedings completed by end of 2016.
- A CPUC proceeding to continue to streamline state jurisdictional interconnection processes to create a ministerial low-cost interconnection process for distributed generation completed by the end of 2015. The CEC to explore similar streamlined processes for interconnecting distributed generation in publicly owned utility systems. The CPUC and CEC consult as appropriate with the CAISO as part of these proceedings.
- ARB will assess existing barriers to expanding the installation of CHP systems and propose solutions (in consultation with the State's energy agencies) to achieve the Governor's objectives and that of the initial Scoping Plan for CHP to reduce GHG emissions. A future CHP measure could establish requirements for new or upgraded efficient CHP systems.
- Evaluate the potential for CCS in California to reduce emissions of CO_2 from energy and industrial sources. Working with DOGGR, CEC and CPUC, ARB will consider a CCS quantification methodology for use in California by 2017.

2. Transportation: Vehicles/Equipment, Sustainable Communities, Housing, Fuels, and Infrastructure

California's transportation system accounts for about 36 percent of California's GHG emissions and is the primary source of smog-forming and toxic air pollution in the State. Mandatory regional criteria pollutant reduction targets will be established in the 2016 State Implementation Plans (SIPs) with expected reductions on the order of 90 percent below 2010 levels in the South Coast and similar reductions in the San Joaquin Valley by the year 2032. Many of the strategies employed to reduce GHG emissions will also work to meet the national ambient air quality standard for ozone in 2032.

Achieving California's long-term criteria pollutant and GHG emissions goals will require four strategies to be employed: (1) improve vehicle efficiency and develop zero emission technologies, (2) reduce the carbon content of fuels and provide market support to get these lower-carbon fuels into the marketplace, (3) plan and build communities to reduce vehicular GHG emissions and provide more transportation options, and (4) improve the efficiency and throughput of existing transportation systems.

As one of the most significant sources of GHG and criteria pollutant emissions, the transportation system represents one of the greatest needs for emission reductions in California, and one of the greatest opportunities to build an economy that aligns stable economic growth with the need for ever-improving public health and environmental protection. Reducing transportation emissions, including those from heavy-duty diesel engines, will have dramatic air quality and public health benefits—especially in many of California's environmental justice communities. Improving vehicle efficiency will continue to cut consumer fuel bills. Diversifying fuel supplies will further decouple economic growth in California from volatile global oil prices and keep more of Californians' fuel expenditures in our own communities. Planning and building communities to reduce travel demands and designing more productive transportation systems will cut transportation costs for California's workers and make the State's freight distribution system more competitive in the global marketplace.

Building on California's Existing Policy Framework

California already has many of the elements necessary for an effective framework to address transportation emissions. The actions identified in this Update represent a natural extension of existing policies, including targeted investment, strategic market support, and coordinated planning for more sustainable development. These recommendations are based on technologies currently available or expected in the near term, and on planning and investment steps that can be taken now. However, to achieve the needed transportation GHG emission reductions and the corresponding 2032 ozone standards, the market uptake of advanced technologies will need to be accelerated. Additional strategies are needed over the next five years to define the paths for longer-term change. As all these actions and policies are implemented, they will need to be consistent with principles and criteria, as recommended by the Environmental Justice Advisory Committee (EJAC), that ensure access, equity, and benefits to vulnerable communities.

To illustrate these additional paths toward significant emission reductions, a number of forward-looking strategies are described in this chapter. These paths envision the use of technologies that require further development. In addition, the market structures, investment strategies, businesses models, regulatory actions, and financial resources to support the very large-scale transition to these technologies need to be identified and put in place.

California's regulatory programs and planning efforts provide a basic foundation to build lasting markets where vehicle/equipment manufacturers, suppliers, and fuel providers who make large, smart investments are handsomely rewarded for developing leading technologies. Standards should drive technologies to higher volumes, lower prices, and ultimately, become market-winning solutions, rather than compliance approaches.

Efficient Vehicle and Engine Technology and Zero Emissions Technology Development

California has made tremendous progress pushing clean vehicle technologies. This progress has led to emission reductions throughout the United States and has pushed market development for clean and zero emission technologies throughout the world. California was the first state in the nation to require reductions of GHGs from motor vehicles when, in 2004, ARB adopted what is commonly referred to as the Pavley regulations resulting from Assembly Bill 1493 (Pavley, Chapter 200, Statutes of 2002). These regulations formed the foundation for the federal GHG and fuel-economy programs for light-duty vehicles for the 2012–2016 model years.

California continues its leadership through ARB's Advanced Clean Cars program, which was developed in part through collaboration with the U.S. EPA and National Highway Traffic Safety Administration (NHTSA). This set of regulations will reduce GHG emissions from new light-duty vehicles by about 4.5 percent per year, from 2017–2025, such that by 2025 a new vehicle will emit about half the GHG compared to today's fleet mix. The Advanced Clean Cars program also included tighter criteria pollutant requirements which, in 2025, will result in cars emitting 75 percent less smog-forming pollution than the average new car sold today.

SUCCESS STORY

Broadband Internet service is now used to save vehicle miles driven for medical care in the South Lake Tahoe area. The California Telehealth Network (CTN), a service available statewide, has collaborated with the UC Davis Health System to upgrade broadband and bring telemedicine equipment to Barton Memorial Hospital. CTN now averages more than 200 patient consultations each month.

As part of the Advanced Clean Cars program, the Zero Emission Vehicle (ZEV) Regulation requires about 15 percent of new cars sold in California in 2025 to be a plug-in hybrid, battery electric, or fuel cell vehicle. Ten other states have adopted California's ZEV Regulation, increasing the reach of California's policy to about a quarter of the U.S. vehicle market. California currently has 60,000 ZEVs (primarily light-duty vehicles, including battery electric, plug-in hybrid, and fuel cell vehicles) on its roadways—more than any other state. Continuing to support and develop zero emission vehicle markets within California and elsewhere is critical to achieving California's emissions reduction requirements. California has outlined several steps in the State's *ZEV Action Plan*,[77] to further support the market and accelerate its growth. Committed implementation of the actions described in the plan will help meet Governor Brown's 2012 Executive Order (EO) B-16-12, which—in addition to establishing a more specific 2050 GHG target for the transportation sector of 80 percent from 1990 levels—called for 1.5 million ZEVs on California's roadways by 2025.

Continuing progress on light-duty vehicles beyond the scope of the Advanced Clean Cars program with a LEV IV standard targeted at achieving additional GHG emission reductions of about five percent per year beyond 2025 would reduce new vehicle emission standards to about 125 grams of carbon dioxide equivalent per mile (gCO_2e/mi) in 2030 and to below 100 gCO_2e/mi by 2035. Furthermore, commercially available technologies, such as fuel efficient passenger vehicle tires, can be utilized by both new and in-use vehicles in the near-term to achieve GHG emission reductions. Deployment of fuel efficient vehicle tires for in-use vehicles could include limited incentives, followed by ratings and then standard setting to permanently shift the market.

Achieving our long-term climate goal and 2032 ozone standards will require a much deeper penetration of ZEVs into the fleet. As outlined in the 2009 ZEV Review[78] and the 2012 Vision for

77 The ZEV Action Plan can be found at *http://opr.ca.gov/docs/Governor%27s_Office_ZEV_Action_Plan_%2802-13%29.pdf*.

78 *www.arb.ca.gov/msprog/zevprog/2009zevreview/2009zevreview.htm* (Refer to Attachment B)

Clean Air,[79] and several independent studies (See Chapter III), the light-duty vehicle segment will need to become largely electrified by 2050 in order to meet California's emission reduction goals.

For the heavy-duty segment, ARB recently approved a regulation establishing GHG emission reduction requirements for all medium- and heavy-duty vehicles and engines manufactured for use in California, harmonizing with the GHG emission reduction rule adopted by the U.S. EPA in 2011. For Class 8 heavy-duty vehicles, this "Phase I" GHG standard will reduce new vehicle emissions by four to five percent per year from 2014–2018.

ARB is working with U.S. EPA on Phase 2 GHG standards for heavy-duty vehicles to continue these reductions beyond 2018. U.S. EPA is planning to finalize Phase 2 standards in 2016. ARB believes additional annual improvements of around five percent through 2025 can be achieved from Class 8 heavy-duty vehicles using commercially available technologies and advanced transmissions, hybridization, improved trailer aerodynamics, and other technologies. In addition, significant, ongoing vehicle efficiencies can be achieved in Class 3–Class 7 trucks during the same time frame. These efficiencies will be partly enabled by improvements in light-duty vehicles; the challenge is to move these technologies from the light-duty sector to the heavy-duty on-road and off-road sectors in order to reach commercialization in the necessary time frame. ARB is working to ensure Phase 2 standards are set at the lowest feasible levels, to accelerate the introduction and deployment of the advanced technologies necessary to meet the State's air quality and climate policy objectives.

While the Phase 2 standards will be an important next step in reducing GHG emissions from heavy-duty trucks, significantly greater reductions will be needed to meet California's climate change goals. To continue reducing emissions, zero and near-zero emission technologies will need to be deployed in large numbers. In addition to clean NG trucks, BEV and FCV technology could be deployed in urban fleet applications and medium-heavy classifications. This is particularly true for fleets that have a central fueling hub. For the heavier classifications with moderate range, strategies could include plug-in hybrid technology with catenary electric infrastructure along transport corridors. For heavy, long-range applications where electrification is not practical, low-carbon sources of energy, such as renewable fuels and hydrogen FCVs, will be necessary.

For successful implementation of these strategies, California needs to make similar commitments to develop zero emission vehicle markets for heavy-duty vehicles and equipment. Many zero emission technologies for trucks have progressed at least to the demonstration phase, and in the case of smaller trucks, battery-powered vehicles are available commercially in small volumes. However, ZEV technology for Class 7 and 8 vehicles, which account for most of heavy-duty vehicle emissions, has not progressed as far as it has for light-duty vehicles. Where the technology is available or being demonstrated, near-term challenges exist in terms of cost, vehicle range, payload, and the need for associated infrastructure. ARB is proposing larger efforts to demonstrate, pilot, and deploy ZEV technologies for heavy-duty vehicles with Cap-and-Trade auction proceeds.

Low-Carbon Fuels

California has an effective, scalable framework in place for fuels to ensure ongoing emission reductions. The Low Carbon Fuel Standard (LCFS), adopted in 2009, requires the carbon intensity of transportation fuels to be reduced by at least ten percent in 2020. While the primary goal is reducing carbon intensity and concomitant greenhouse gas emissions, implementation will also necessarily diversify the fuel portfolio, reducing the economic impact in California from gasoline and diesel price spikes resulting from volatile global oil price changes. As a result of California's leadership, other states and countries are pursuing the development of carbon-intensity fuel measures. In addition, fuels will come under California's Cap-and-Trade Program in 2015. Together, LCFS and Cap-and-Trade provide a structure to ensure that necessary emission reductions are achieved and provide an effective market signal to accelerate innovation and

79 *www.arb.ca.gov/planning/vision/vision.htm*

development of cleaner fuels. Continuing these policies beyond 2020 will ensure that fuel carbon intensity continues to decline and that low-carbon alternatives to petroleum are available in sufficient quantities in the long term. Research that further refines our understanding of fuel carbon intensity is similarly important and should include an assessment of methane emissions from natural gas systems. Achieving the GHG and air quality goals will require a renewable portfolio of transportation fuels—including electricity and hydrogen—well beyond the current policy trajectories. Accordingly, in 2014 ARB will consider extending the LCFS, with more aggressive targets for 2030.

Transportation, Land Use, and Housing

As a result of Senate Bill (SB) 375 (Steinberg, Chapter 728, Statutes of 2008), the Sustainable Communities and Climate Protection Act of 2008, California has developed a critical, unique policy mechanism for reducing transportation-sector GHG emissions. Regional and local planning agencies are responsible for developing Sustainable Communities Strategies (SCS) as part of the federally required Regional Transportation Plan (RTP), and also responsible for developing State-required general plan housing elements to help meet these targets. The goal of SB 375 is to reduce GHG emissions from passenger vehicles through better-integrated regional transportation, land use, and housing planning that provides easier access to jobs, services, public transit, and active transportation options.

Sustainable Communities Strategies promote more travel and housing choices through greater access to alternative forms of transportation (including public transit, biking, and walking) and development patterns where people can live, work, and play without having to drive. All seven metropolitan planning organizations (MPOs) that have adopted SCS so far have met or exceeded the ARB-set targets. Successful implementation of these SCS is the critical next step in achieving the associated GHG emission reductions.

Implementation of these strategies hinges on local actions to realize the GHG emission reductions envisioned in the regional SCS. The State must encourage new and targeted strategies to reduce emissions throughout California's diverse communities. The State's role is to provide ongoing support, through access to financial resources and incentives, guidance documents, housing element certification, planning tools, and other forms of technical assistance. California has a number of important planning tools available to reduce vehicle travel demand, expand mobility options, and improve goods movement; however, these tools will need to be enhanced and new tools will need to be developed, including but not limited to land use models, health models, and scenario planning tools. With appropriate coordination among local and State agencies—including ARB, the California Department of Transportation (Caltrans), the Strategic Growth Council (SGC), and the Department of Housing and Community Development (HCD)—California can ensure that the expected GHG emission reductions are achieved or exceeded. The State must also support integration of the planning, development, and funding of transportation systems, including recognition of the impacts and interactions between passenger and freight transportation.

In 2014, ARB will review the advancements in data, models, analytical methodologies, and technologies that have taken place since 2010 to inform the need for and timing of revised MPO targets. This technical review will provide the foundation for a future target revision, consistent with each MPO's time frame for updating its RTP under federal law. Future updates to SCS targets, along with other new transportation strategies, will help provide further emission reductions needed to achieve long-range reductions in transportation-related emissions.

Coordinated, comprehensive planning is critical to achieving deep emission reductions in the transportation sector, and must include the development of the 2014 California Freight Mobility Plan (Caltrans), the 2014 Sustainable Freight Strategy (ARB), the 2040 California

Transportation Plan in 2015 (Caltrans), the 2016 SIP (ARB, SCAQMD,[80] SJVAPCD[81]), and all future regional sustainable community strategy and Regional Transportation Plan development and implementation. These planning efforts will need to identify the infrastructure, including fueling and intelligent transportation infrastructure, needed to support full-scale deployment of advanced technologies, improved throughput, and expanded access to rail, public transit, and active transportation.

As State agencies proceed with GHG emission reduction planning, it is necessary to integrate the need for significant NO_x reductions by 2032 to meet the national ambient air quality standards for ozone. Tools developed to support these planning efforts should emphasize the needs of vulnerable communities, as recommended by EJAC. These needs include, but are not limited to: access to affordable public transit, electric vehicle charging, or other low-carbon fueling infrastructures; accessible affordable housing; and localized public health benefits.

California is implementing a large-scale rail modernization program, which includes the nation's first true high-speed rail (HSR) system. Europe's experience with high-speed rail is illustrative of its mode-shift potential; after high-speed rail launched in Europe, air trips were cut in half from Paris to London. In Spain, for the 315-mile trip from Barcelona to Madrid, more than 60 percent of air travelers have switched to the 2½-hour rail ride. The first construction contract to begin California's high-speed rail system was awarded in August 2013, for work in the Central Valley. Additionally, environmental work is proceeding to electrify the Caltrain corridor in the Bay Area by 2019 as part of the high-speed rail system. High-speed rail will provide a new, clean, interregional transportation option and increase ridership on integrated regional rail and local transit systems, reducing single-occupancy vehicle trips.

Systems Efficiencies

California is at the forefront of developing additional strategies to reduce emissions from existing vehicles and systems. In fact, many system efficiency strategies identified in the initial Scoping Plan have been implemented or are still under development such as ship electrification at ports, tire pressure, fuel-efficient tires, and low friction motor oils. These strategies go beyond just vehicle improvements; for example, Caltrans has initiated several strategies that achieve GHG emission reductions from the existing system, including modification to concrete specifications, alternative asphalt pavements, and adoption of the Caltrans Complete Streets Implementation Action Plan[82], which spurred a series of comprehensive edits to its Highway Design Manual.

However, California must do more to capture significant potential emission reductions from existing systems that could also improve safety, reduce congestion, and improve economic productivity and workforce and businesses competitiveness. For example, improved pavement engineering—including surface smoothness, rigidity, and durability—can reduce GHG emissions through improved fuel efficiency. Smart phone and vehicle "apps" that provide real-time travel information and eco-routing or eco-driving suggestions can reduce emissions from existing vehicles. Coordinating signal timing and providing real-time information to drivers about signal status can reduce emissions in urban driving by up to ten percent. Utilizing adaptive cruise control, a global positioning system (GPS), and camera technologies to enable truck "platooning" can reduce GHG emissions and fuel consumption from those vehicles by about 15 percent.

Myriad existing and emerging technologies will lead to an increasingly connected and automated transportation system and could have dramatic efficiency and emissions benefits. Many automakers and others have committed to bring varying levels of automation to new vehicles over the next five years, and the NHTSA is beginning to take steps to enable vehicle-to-vehicle and vehicle-to-infrastructure communications. The degree to which markets for these vehicles grow—and how local, State and federal rules shape and support them—will determine the

80 South Coast Air Quality Management District
81 San Joaquin Valley Air Pollution Control District
82 *www.dot.ca.gov/hq/tpp/offices/ocp/complete_streets_files/CompleteStreets_IP03-10-10.pdf*

level of emissions impact from these technologies. Early studies show that vehicle automation could enable dramatic emissions decreases, or emissions increases, depending on the level of increased vehicle and systems efficiency they enable, how the vehicles integrate with an alternative fuels infrastructure, and the degree to which they may induce additional vehicle travel.

Over the next five years, it will be critical to begin planning for these vehicles on our roads and to maximize their benefits and potential for GHG emission reductions. California is already a leader in this emerging space, and the California Department of Motor Vehicles has issued the nation's first draft rules regulating the testing of autonomous vehicles on California's roads, pursuant to Senate Bill 1298 (Padilla, Chapter 570, Statutes of 2012). Many are also looking to California's I-710 corridor to begin demonstrating and deploying intelligent transportation system technologies for heavy-duty trucks. Additional research is needed to better understand the impacts these vehicles will, or can, have on GHG emissions in California's transportation sector, and how to best integrate automated vehicles within the State's existing and evolving vehicle, fuel, and planning policy framework. The next Scoping Plan Update will include additional detail on the role of existing systems improvements and vehicle automation in meeting California's transportation-sector emissions reduction goals.

Integrated Policy Planning in the Sustainable Freight Strategy

California has already made significant progress reducing emissions from its freight system, while supporting our ports and goods movement industries as some of the most critical to the State's economy. Through regulations, incentives, enforcement agreements, port and industry initiatives, project mitigation and land use decisions, California has reduced diesel PM emissions—along with the associated health risks—by 70 percent at the largest ports and about 50–70 percent at the highest-risk railyards since 2005. However, much more needs to be done to continue to reduce the impacts from air pollution, including diesel PM at the local level, ozone at the regional level, and GHGs at the global level. The ongoing planning, policy foundation, financial incentives, and state commitment to reduce PM and NO_x emissions from the freight system provide a foundation from which to develop a similar framework to reduce GHG emissions.

Over the past decade, public and private stakeholders across California have increasingly recognized the need to plan and implement multi-pollutant emission reduction strategies that achieve transformational changes resulting in significant reductions of near-source toxic, regional criteria pollutant, and global GHG emissions. SB 375 uses this integrated, multi-pollutant approach to reduce passenger vehicle GHG emissions through strategies that impact land use and housing decisions, transportation infrastructure funding, and regional criteria pollutant analyses.

A parallel effort to SB 375 needs to reside in the freight sector, with its highly complex international logistics system and incredibly diverse set of stakeholder groups. To achieve our multi-pollutant goals, over the long-term California must transition from a diesel-dependent system into one with significant numbers of zero and near-zero emission engines for trucks, locomotives, cargo-handling equipment, ships, and aircraft. California must also support the parallel development of the necessary supporting infrastructure, and implement logistical/efficiency improvements to reduce the emissions impact of moving freight. In short, the freight sector must become a system that is efficient, reliable, clean, and low carbon.

The Sustainable Freight Initiative[83] (Initiative) is a broad, multi-decade effort to develop, fund, and implement the changes necessary to achieve a sustainable freight system. The Initiative will be informed by an ongoing, transparent process that engages all freight stakeholders. These include, but are not limited to: industry (such as retailers and other cargo owners, shipping, trucking, rail, and warehousing), ports, labor, environmental groups, business leaders, venture capitalists, community representatives, technology developers, air districts, and representatives from local, State, and federal government.

83 *www.arb.ca.gov/gmp/sfti/sfti.htm*

The 2014 Sustainable Freight Strategy (Strategy) is a concentrated, one-year effort to produce a document developed in the context of the broader Initiative and represents the next milestone in defining what is necessary to move California toward a sustainable freight system. Building a coalition of freight stakeholders is a primary focus of the Strategy, and will ultimately be a significant driving force behind affecting change in areas outside of ARB's sphere of influence, including advocating at the federal level and acquiring public and private funding for implementation.

The South Coast Zero-Emission Freight Transport Technology Symposium and ARB's Haagen-Smit Symposium in mid-2013 provided early input into the sustainable freight effort. Currently, there are a number of existing venues led by both public and private entities where California freight issues are being discussed. These are critical to ARB's public process for the sustainable freight effort, and were some of the earliest points of engagement in the process.

ARB will work with stakeholders on the Strategy throughout 2014, with the ultimate goal of setting California on the path to move freight more efficiently and with zero/near-zero emissions. This work must recognize the equally important priorities of transitioning to cleaner, renewable energy sources, providing reliable velocity and expanded system capacity; integrating with the national and international freight system; and supporting clean air and healthy communities. The Initiative should also recognize the value of: keeping California's ports and logistics industry competitive; supporting the delivery of California's products locally and to other states and countries; creating jobs in California and training local workers to support the new transport system; increasing energy security; and improving mobility.

The 2014 Strategy will include several key elements that together will provide a holistic look at the freight system and identify actionable next steps through 2020. The Strategy will: identify near-term actions resulting from assessments of each of the freight sectors and the system, prioritize efficiency improvements, include principles and criteria for transportation infrastructure projects, and begin to answer the following questions:

- What actions and changes must take place within California's freight system to address air quality and climate requirements?
- What are the technology gaps?
- What research and demonstration is needed?
- What incentives are needed to drive technology, infrastructure and efficiency improvements?

To that end, ARB is working with agency partners to expand upon existing and ongoing technology assessments in all the major freight-related source categories, including: trucks, locomotives, ocean-going vessels, commercial harbor craft, cargo equipment, and air cargo/airports. These assessments will draw from technology expertise in the public and private sector, and will lay the framework for identifying and prioritizing the next steps, including accessing and leveraging funding, near-term implementation strategies, and longer-term actions that could be included as measures in upcoming SIPs.

This technical effort will also provide an opportunity to evaluate the types and availability of data and how they could be collected and ultimately used to quantify the emission reduction potential of future measures for each sector. Technology-specific objectives include, but are not limited to, the following:

- Accelerate the introduction and deployment of zero and near-zero emission trucks, including trucks capable of zero-emission miles.
- Continue improving the efficiency of trucks (both engines and vehicles).
- Support development and introduction of locomotives capable of zero emission track miles.
- Accelerate cleanup of the existing locomotive fleet.

- Increase near-dock rail in Oakland/Los Angeles/Long Beach.
- Reduce GHGs and criteria pollutants from ocean-going vessels.
- Build on the work done by the U.S. Department of Defense on cleaner fuels/aircraft design to reduce GHGs and criteria pollutants from air cargo.
- Identify efficiency improvements on all levels (equipment, sector, and system).
- Showcase strategies and best practices.

In addition, ARB will develop principles and criteria that seek to establish air quality and climate benefits as equal to established transportation/mobility metrics in determining the priority of freight-related transportation projects and recommend inclusion of these principles and criteria in the 2014 Freight Mobility Plan. ARB is participating on the California Freight Advisory Committee and will coordinate with Caltrans staff to reflect the outcome of this effort in the California Freight Mobility Plan.

Moreover, the Strategy process provides the opportunity to begin evaluating the feasibility of a systemwide efficiency metric(s) that could track upstream and downstream impacts of implemented emission reduction and efficiency strategies. The metric could be used to set targets, prioritize funding, evaluate projects, evaluate programs, and gauge performance or progress across modes. To complement a metric, ARB will seek advice on actions that government could take to support efficiency improvements. ARB will also begin efforts to define criteria and principles for new and expanded freight infrastructure projects as a tool for local land use decision makers and community residents.

Supporting Planning and Market Development through Targeted Investments

Incentive funding is essential to encourage use of alternative transportation modes, develop and deploy low-carbon fuels, spur fleet turnover, and continue to develop advanced technologies. Through the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer), Proposition 1B program for goods movement, and AB 118 Air Quality Improvement Program (AQIP), ARB provides funding, directly or through the air districts for technologies that reduce criteria pollutant and air toxic emissions, often with concurrent climate change benefits. A subset of these funds, about $283 million to date, are utilized for advanced technologies that achieve GHG emission reduction benefits, which include: rebates for light-duty clean cars, vouchers for hybrid and zero emission heavy-duty trucks, grants for installation of shore-based electrical power for ships, and technology demonstrations such as hybrid tugboat retrofits.

In 2013, the State extended fees for AQIP until 2024 which is expected to provide about $25 million annually for advanced technologies. Most recently, the Governor's proposed budget for Fiscal Year 2014–15 would direct $200 million from Cap-and-Trade auction proceeds to ARB for low-carbon transportation to respond to the increasing demands for incentives of these technologies and for pre-commercial demonstration of advanced freight technology. In addition, the CEC's AB 118 Alternative and Renewable Fuel and Vehicle Technology Program invests $100 million annually (also extended until 2024) to develop and deploy alternative and renewable fuels, fueling infrastructure, vehicles, and workforce skills necessary operate and maintain these new technologies. Finally, Senate Bill 99 creates an active transportation program to increase funding of bicycle and pedestrian infrastructure, which is funded at an annual level of $129 million.

These current efforts will need to be enhanced or expanded beyond currently allocated resources. To implement this, protocols that outline funding priorities will need to be reviewed and metrics should be developed for evaluating investment opportunities. For example, existing State rebates for light-duty zero emission and plug-in hybrid vehicles are consistently oversubscribed, yet continued public commitment is necessary at this time to support full-scale commercialization and consumer acceptance of these vehicles. Furthermore, the vehicle regulations and incentives for both light- and heavy-duty vehicles must be supported through

parallel investments in infrastructure and additional policies to ensure that value is returned to consumers. These policies include setting reasonable electricity rates that encourage electrification and vehicle charging rates that strongly encourage off-peak charging or are responsive to grid operational needs and policies that manage charging to facilitate renewable energy uptake. They also include streamlining local permitting, siting, and utility interconnection for fueling infrastructure.

Additional investments will be necessary for advanced technology freight demonstration projects and pilot deployments of advanced heavy-duty vehicles and equipment in a variety of vocations. Near-term focus areas for these projects include, but are not limited to: zero emission port trucks for near-dock rail pilot projects; pilot projects to deploy zero emission and hybrid vehicles and equipment at distribution centers located in areas most affected by air pollution; and development and demonstration of advanced technology locomotives, marine vessels, and cargo handling equipment.

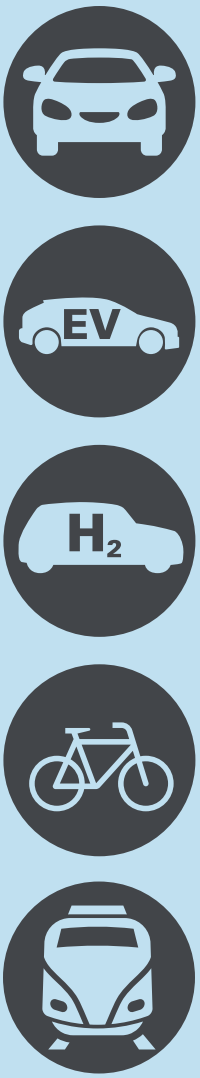
Investment throughout California in projects that modernize the passenger rail system and link seamlessly to local public transit systems will continue to build public transit ridership and shift travelers from single-occupancy vehicles to public transport. As a start, in 2008, voters approved Proposition 1A, authorizing nearly $10 billion in state bonds for the United States' first high-speed rail line, which would connect the San Francisco Bay Area with Los Angeles. Rail modernization in California will increase benefits for passengers, including improved mobility and safety, with a reduced carbon footprint. Prior to 2030, high-speed rail will reduce GHG emissions by providing a cleaner alternative to air and private car travel. It is projected to realize GHG emission reductions its first year in operation, with annual increases in GHG emission reductions as the system expands.[84]

Rail modernization infrastructure investments must be coordinated with local and regional planning to be mutually supportive. As part of the early development of high-speed rail, commuter and urban rail systems are being upgraded and expanded to provide connectivity to the future high-speed rail system. In addition, work has begun on shared-use investments that high-speed rail will ultimately access, such as the electrification of the Caltrain corridor between San Francisco and San Jose, which is scheduled to be operational in 2019. Coordination among regional and urban rail providers on issues such as schedules and integrated fare mechanisms will provide increased service, speed, and amenities that will grow this clean mode of travel and encourage transit-oriented development and infill around station locations.

Furthermore, ongoing investments are needed for local communities to plan and implement sustainable community development, including integrated public transit and high-speed rail, incentivizing transit utilization, and to address both passenger and freight transportation infrastructure needs. Active transportation and public transit alternatives, including zero-emission transit buses, are increasingly in demand and are necessary to meet ongoing emission reduction targets. Caltrans, working with local and regional agencies, will need to coordinate on transportation infrastructure funding (including construction, operation, and maintenance costs) and consider lifecycle benefits and impacts (including environmental, construction, operation, and maintenance costs) for transportation infrastructure projects.

84 *www.hsr.ca.gov/docs/programs/green_practices/HSR_Reducing_CA_GHG_Emissions_2013.pdf*

Key Recommended Actions for the Transportation System



Vehicle Technology

- The 2017 mid-term review for Advanced Clean Cars, where ARB, U.S. EPA, and NHTSA will conduct a technical assessment of vehicle technology trends, will inform future light-duty vehicle standards targeted at continuing to achieve GHG emission reductions of about five percent per year through at least 2030.
- In 2016, ARB will propose rules and/or incentives, including the "Phase 2" heavy-duty vehicle GHG standards in conjunction with U.S. EPA and NHTSA with a goal of achieving new vehicle GHG emission reductions of at least five percent per year.
- For completion by 2017, ARB will engage the Office of Planning and Research (OPR) and other stakeholders to expand upon the 2013 ZEV Action Plan for medium- and heavy-duty ZEVs.

Fuels

- In 2014, ARB will propose enhancements to strengthen the LCFS. ARB will also consider extending the LCFS beyond 2020 with more aggressive long-term targets, such as a 15 to 20 percent reduction in average carbon intensity, below 2010 levels, by 2030.
- By 2018, the CPUC, CEC, California Department of Food and Agriculture (CDFA), and ARB will evaluate and adopt the necessary regulations and/or policies to further support commercial markets for low-carbon transportation fuels, including but not limited to:
    - Reducing off-peak demand charges for electricity and plug-in vehicle charging rates that strongly encourage off-peak charging both at home and at public chargers;
    - Development of large-scale renewable and low-carbon production facilities through continued funding for infrastructure;
    - Development and adoption of performance and quality standards;
    - Streamlined local permitting and siting for hydrogen fueling and charging infrastructure and utility interconnection for charging infrastructure; and
    - Research.

Transportation, Land Use, and Housing

- In 2014, ARB will complete a technical review that will inform the need for and appropriate timing of revisions to the SB375 regional targets established in 2010.
- The High-Speed Rail Authority will work with other rail and mass transit providers to increase transit ridership both regionally and inter-regionally.
- The High-Speed Rail Authority will continue construction of the HSR system, beginning with completion of all station-area planning by 2017 followed by completion of the initial operating segment in 2022. By 2029, HSR will run from San Francisco to Los Angeles.
- ARB, Caltrans, SGC, and HCD, along with other State, local, and regional agencies, will coordinate planning and support to ensure that the expected GHG emission reductions from approved SCS are achieved or exceeded.

Sustainable Freight Strategy

- In 2014, ARB will complete the first phase of the Sustainable Freight Strategy, which will identify and prioritize actions through at least 2020 to move California towards a sustainable freight system.

Investments

- Leverage available public money to scale-up clean technology markets and strategies and ensure necessary infrastructure investments, including the following:
  - ARB, CEC, CPUC, and CDFA will support growing markets for clean passenger transportation, advanced technology trucks and equipment, and low-carbon transportation fuels and energy, including any necessary infrastructure.
  - Caltrans, working with local and regional agencies, will consider lifecycle benefits and impacts (including environmental, construction, operation, and maintenance costs) for transportation infrastructure projects.
  - Caltrans and regional transportation agencies will increase investment in expanded transit and rail services, active transportation, and other VMT-reduction strategies in their next regional transportation plans.
  - SGC will support SCS implementation, including, for example, integration of the regional transportation and Regional Housing Needs Allocation planning, as well as provision of local assistance for transit, active transportation, and affordable transit-oriented housing development; therefore offering more efficient consumer choices.
- State agencies, including ARB and Caltrans, will incorporate into ongoing GHG planning efforts strategies that help achieve significant NO_x reductions by 2032 to meet the national ambient air quality standards for ozone. The 2016 SIPs will outline attainment strategies through 2032.

3. Agriculture

Agriculture in California provides a safe, reliable, and affordable food source to support growing local, State, national, and global populations. It is also a key economic driver in the State. California has a range of climatic regions that allow for the production of a diverse variety of annual crops (such as vegetables and grains), perennial crops (such as fruits and nuts), and livestock and dairy products. As one of only five Mediterranean growing regions on Earth, California is a major contributor to the global food supply; particularly of fruits, nuts, vegetables, and dairy products.

California's agricultural GHG emission inventory includes on-site emissions from enteric fermentation (by animals), manure management, rice cultivation, energy use (including fuel combustion), crop residue burning, and soil management practices (fertilizer and manure applications). The primary GHG emissions from agriculture include methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O), and black carbon. In 2012, agricultural sources accounted for about eight percent of California's total GHG emissions. In addition to being a GHG emissions source, agriculture can also be a carbon sink, where carbon is stored (sequestered) in both crops and soil.

Many of the strategies to reduce GHG emissions or increase sequestration in the agriculture sector overlap and have synergies with other sectors. For example, agricultural operations are the largest water users in the State. Because water use is a significant source of GHG emissions (due to the electricity used to pump water), conservation and water delivery efficiency improvement efforts employed in agricultural operations would support GHG emission reduction goals in the water sector. Agricultural operations can also contribute to the strategies for reducing GHG emissions in the energy sector by providing biomass feedstock resources for bioenergy production (for both fuels and electricity). Reduction strategies described in the transportation, land use, fuels, and infrastructure sector could also be realized through agricultural land conservation efforts, and through operational efficiency improvements that reduce transportation emissions and fuel use.

Due to the wide diversity of crop and livestock production, the agricultural sector presents unique challenges to controlling GHG emissions. The initial Scoping Plan considered voluntary steps to reduce GHG emissions in this sector in place of regulatory measures, due primarily to costs and scientific uncertainty in measuring GHGs in many agricultural systems.

The installation of manure digesters to reduce methane emissions was included as a voluntary strategy for the agricultural sector in the initial Scoping Plan. However, voluntary installation of anaerobic digesters at dairies in California has not increased as expected. This is due to the recent economic recession, increased feed and fuel prices, lack of sufficient financial incentives, and insufficient utility contracts. ARB is working with federal, State, and local agencies, as well as with industry stakeholders, to remove obstacles to digester installations. Critical to this is the continued effort to evaluate the many co-benefits of manure management through digesters. The evaluation will examine the potential for successful voluntary efforts to be more widely adopted in California. As new information becomes available, ARB will work with stakeholders to determine whether and how the program should become mandatory and/or more strongly incentivized.

The initial Scoping Plan also called for research on baseline nitrous oxide (N_2O) emissions from the use of fertilizers to improve the GHG inventory. ARB, CEC, and CDFA have been coordinating and funding research to determine baseline N_2O emissions from a variety of soil types, crops, and farming techniques used throughout California. Research began in 2009 and is expected to be completed by the end of 2014.

A number of other potential voluntary GHG-reduction activities were mentioned in the initial Scoping Plan, including improvement of agriculture water use efficiency, increasing the efficiency of or electrification of agricultural water pumps, using biomass-based fuels, and increasing carbon sequestration on agricultural lands.

The CDFA, in partnership with scientists at the University of California (UC) at Davis, and with funding from the CEC, are evaluating the economic, beneficial environmental factors and costs of biofuel feedstock crops. Outcomes will focus on cropping systems for California with best management practice recommendations; estimates of direct environmental costs such as water use, input levels, and effects; and potential off-farm environmental consequences. The CDFA is working with ARB to expand use of biomass-based transportation fuels as a regulatory pathway under the Low Carbon Fuel Standard.

The CDFA is also supporting projects that address GHG mitigation through its Specialty Crop Block Grant Program (SCBGP). Results of funded research projects provide knowledge and tools to help growers reduce GHG emissions and increase carbon sequestration.

As discussed in Chapter II, there is increased recognition of the significant role that short-lived climate pollutants have on climate change. In response, the importance of methane emissions from agricultural operations, particularly from rice and cattle operations, has increased. Consequently, there is a need for enhanced efforts to secure additional methane reductions from agricultural operations.

Maintaining Momentum

There are many GHG emission reduction and carbon sequestration opportunities that could be realized in the agriculture sector. However, because of limited research, and the wide variety of farm sizes, animals, and crops produced, there are few one-size-fits-all emission reductions or carbon sequestration strategies for the agriculture sector.

Agricultural operations throughout the State are variable, there are a number of potential GHG sources at each operation, and a number of potential co-beneficial management practices can be used for each source. To address this complexity, one approach to reducing GHG emissions from agriculture in California is to develop agriculture-sector mid-term and long-term 2050 GHG emission reduction planning targets.

To meet GHG emission reduction planning targets, farmers and ranchers could assess their on-farm GHG emissions and determine which GHG emission reduction management practices work best for their particular situation. In many cases, pursuing the GHG emission reduction practices would build on existing efforts already in use to increase operational efficiency, reduce criteria pollutant emissions, and reduce costs.

The sections below detail some of the areas with potential emission reduction/sequestration opportunities, as well as areas that need additional research. These opportunities may yield multiple co-benefits, including cost and resource savings, to growers.

Nitrogen Management

Nitrogen fertilizers applied to crops release N_2O, a significant source of agricultural GHG emissions. Obtaining more specific data on statewide fertilizer use in agriculture

SUCCESS STORY

The broadband Internet technology driving the information revolution is also driving revolutions in energy efficiency and GHG reductions for farming. So-called M2M (machine-to-machine) technology now allows precision farming technology to more efficiently apply fertilizers and pesticides, helping reduce GHGs and other air pollutants. Wireless soil moisture sensors reduce water use, saving electricity costs for pumping and moving the water. Some growers claim crop yield increases as a result of more effective monitoring and timing of irrigation—a benefit appreciated all the more during a drought.

and nitrogen deposition on land would help ARB determine baseline emissions and improve the GHG N_2O inventory. This information would also help guide the development of potential GHG emission reduction measures. Existing nitrogen tonnage reports and new reporting requirements under development by the Regional Water Quality Control Board (RWQCB) could be utilized to improve the existing GHG N_2O inventory for fertilizer. Further examination of these data will help determine if broader statewide fertilizer use reporting is needed.

There are several practices that have been shown to reduce emissions of N_2O in agriculture, including the use of nitrification inhibitors, fertigation (the application of fertilizer through irrigation systems), and other approaches. When fertigation is combined with precision drip irrigation there are opportunities to both reduce water and nitrogen fertilizer use. Additional research is needed to evaluate the potential for GHG emission reductions.

Manure Management

Livestock manure is a significant source of methane, and approximately half of the methane generated from livestock comes from manure storage lagoons. The methane generated from those lagoons can be captured by covering the lagoons and can be used to produce energy or renewable fuel (e.g., with the use of a digester).

Soil Management Practices

Historically, tilling (loosening and turning) of soil has been a fundamental agricultural practice to suppress weeds and loosen compacted clay soils. However, tillage releases large quantities of CO_2 and N_2O from the soil into the atmosphere. Several alternative methods, including changing tillage or cropping patterns, may reduce the release of GHGs. Some soil management practices, such as reduced tilling, can also result in reduced fuel consumption by farm equipment, providing additional permanent reductions in GHG emissions, including short-lived climate pollutants.

Water and Fuel Use

A new generation of technologically advanced tools, such as remote irrigation systems, will play an important role in water conservation efforts, maximizing operational efficiency and optimizing resources that can also reduce GHG emissions. In addition, the application of precision irrigation to crops can reduce water use (in turn, reducing the GHG emissions associated with the energy needed to deliver the water), which may also reduce fertilizer use—both of which can reduce emissions and costs.

Greenhouse gases and other emissions from the operation of internal combustion engines that power farm equipment and water pumps are a concern from a regional air quality and climate change perspective. To reduce emissions, the cleanest, most-efficient, and well-maintained equipment should be used for agricultural operations.

The agriculture sector can also play an important role in producing fuels. Biofuel production is a renewable energy resource that reduces reliance on fossil-based fuels. Fueling equipment with biofuels generated on-site or nearby can also reduce emissions and fuel costs.

Land Use Planning to Enhance, Protect, and Conserve Lands in California

Recent research has shown that GHG emissions from urban areas are much greater than those from agricultural lands on a per-acre basis. As California's population increases, pressures to convert agricultural croplands and rangelands to urban and suburban development also increase. Conservation of these lands will be important in meeting our long-term climate goals. Farmland and open space conservation can be an important policy to support the objectives of the Sustainable Communities Strategies, including reducing vehicle miles traveled. This could be accomplished by using incentives for conservation easements, supporting urban growth boundaries, and maintaining agricultural zoning.

As also described in the Natural and Working Lands Sector section below, to meet the State's GHG reduction goals it is important to take an integrated and coordinated approach to local land use planning that considers all land types, including urban, agricultural, and natural and working lands, within and across jurisdictions, to create interconnected land areas and ecosystems. Local and regional land use planning actions and policies need to more fully integrate and emphasize land conservation and avoided conversion of croplands, forests, rangelands, and wetlands, as well as expansion and promotion of urban forestry, urban agriculture, and green infrastructure.

Highly Efficient Conventional and Organic Agriculture Systems

Highly efficient management systems (precision agriculture) for both conventional and organic farming may provide climate benefits through reduced GHG emissions and increased carbon sequestration. To realize such systems, a host of agricultural management practices might be required. In addition to potentially reducing GHG emissions, these strategies may also have co-benefits such as reductions in energy and fossil fuel use and improvements in soil carbon content and water quality.

Research, Technical Assistance, and Incentives

Over the past several years significant progress has been made in understanding agricultural GHG emissions and the strategies that can provide climate benefits. Through research, technical assistance, and financial incentives, farmers and ranchers have implemented many successful GHG emission reduction strategies. Priority should be placed on continued coordination and leveraging of funding between State, local, and national conservation programs to help farmers and ranchers implement GHG emission reduction practices.

Key Recommended Actions for the Agriculture Sector

- In 2014, convene an interagency workgroup that includes CDFA, ARB, CEC, CPUC, and other appropriate State and local agencies and agriculture stakeholders to:
  - Establish agriculture sector GHG emission reduction planning targets for the mid-term time frame and 2050.
  - Expand existing calculators and tools, to develop a California-specific agricultural GHG tool for agriculture facility operators to use to estimate GHG emissions and sequestration potential from all on-farm sources. The tool would include a suite of agricultural GHG emission reduction and carbon sequestration practices and would allow users to run different scenarios to determine the best approach for achieving on-farm reductions.
  - Make recommendations on strategies to reduce GHG emissions associated with the energy needed to deliver water used in agriculture based on the evaluation of existing reporting requirements and data.
- The Dairy Digester Workgroup will develop recommendations for a methane capture standard by 2016.
- Conduct research that identifies and quantifies the GHG emission reduction benefits of highly efficient farming practices, and provide incentives for farmers and ranchers to employ those practices.
- By 2017, evaluate the data reported to the RWQCB's Long Term Irrigated Lands Regulatory Programs to determine if the reported fertilizer data are adequate to establish a robust statewide GHG N_2O inventory for fertilizer used in agriculture. If existing data are not adequate to develop an inventory, then develop a mechanism to collect the necessary data.
- In 2015, OPR, the California Natural Resources Agency (CNRA), the California Environmental Protection Agency (CalEPA), CDFA, and ARB will convene an inter-agency workgroup to engage local and regional land use planning agencies in establishing a coordinated local land use program to develop recommendations and targets for incorporating farmland conservation in local and regional land use planning.
- CDFA will strengthen technical assistance programs and associated financial incentives to help agricultural operators develop carbon plans and implement GHG emission reduction practices.
- In 2015, the Bioenergy Interagency Working Group will:
  - Strengthen, refine, and implement actions contained in its Bioenergy Action Plan to promote the input of digester biogas into natural gas pipelines and bioenergy onto the electric grid.
  - Evaluate the potential biomass energy generation capacity.
  - Develop methods to quantify biomass life-cycle GHG flux.

4. Water

In addition to being an essential element for all life, a reliable, clean, and abundant supply of fresh water is a critical component of California's economy. The State's developed surface and groundwater resources support a variety of residential, commercial, industrial, and agricultural activities. Therefore, the development and management of the State's water resources has implications for each of the focus areas evaluated in the updated Scoping Plan.

More than 40 percent of California's total fresh water supply (or about 80 percent of developed water resources) is used to support the State's extensive agricultural industry and, therefore, has critical ramifications for the agricultural focus area. A significant amount of water is also used to support residential, commercial, and industrial activities within California's extensive metropolitan and suburban areas. Therefore, a reliable water supply also has important ramifications for future population growth and economic development as examined within the transportation, fuels, and land use focus area. Water is also used to cool power plants and produce hydropower, and therefore has important implications for the energy focus area.

California's water system includes a complex infrastructure that has been developed to support the capture, use, conveyance, storage, conservation, and treatment of water and wastewater. Greenhouse gas emissions from the water sector come primarily from the energy used to pump, convey, treat, and heat water. As such, water sector emission reductions are primarily associated with reducing the amount of electricity and natural gas used within the water sector.

The storage, conveyance, and treatment of water in California consume large amounts of electricity. Approximately 19 percent of the electricity and 30 percent of non-power plant natural gas consumption is used by the water sector. Water is used to grow crops, support urban and industrial needs, and produce energy. Therefore, most of the water measures included in the Scoping Plan focused on the GHG emission benefits derived from reduced energy use, and the emission benefits are reflected in those sectors.

The State is currently implementing several targeted, agricultural, urban- and industrial-based water use efficiency, recycling, and conservation programs as part of an integrated water management effort that achieves GHG emission reductions within the water sector. California's water community is continuing collaborative efforts to reduce its carbon footprint while improving water supply reliability, drought resilience, and public safety; fostering environmental stewardship; and supporting a stable State economy.

California's 2009 Water Conservation Act (Senate Bill x7-7) specifically addresses urban and agricultural water conservation. The Act's key urban provision established an aggressive statewide goal to reduce per capita water use by 20 percent by 2020. To date, 400 urban water agencies have prepared water management plans, which cover close to 80 percent of California's population.

The State has also set ambitious goals for development of alternative water sources such as recycled water and stormwater. The State Water Resources Control Board (SWRCB) adopted recycled water and stormwater goals through a stakeholder-driven process. Recycled water usage is to be increased above the 2002 usage levels by at least one million acre-feet per year by 2020 and by at least two million acre feet per year by 2030. Stormwater usage is to increase above the 2007 usage levels by at least 500,000 acre-feet per year by 2020 and by at least one million acre-feet per year by 2030. Grant and loan programs have provided over $1.15 billion for recycling and stormwater capture infrastructure, and projects are coming online.

In addition, the State has invested $1.5 billion to support 48 regional collaborative efforts to develop water management plans, diversify regional water portfolios, and increase regional water supply self-reliance to support future growth and development. Governor Brown has also taken action to permanently reduce water use consumption by directing State agencies and departments to reduce their overall water use by ten percent by 2015 and 20 percent by 2020.[85]

85 See Executive Order B-18-12, issued on April 25, 2012.

The ongoing drought in California affects energy management as well as water systems. Reduced snowpack decreases hydroelectricity production, and reduced surface flows create additional demands for groundwater pumping. These relationships highlight the need for closer coordination between water and energy managers. Coordinated water and energy investments can be coordinated to maximize GHG emission reductions, if local and State agencies work together to identify project designs that best serve both purposes.

Maintaining Momentum

The primary mechanisms to reduce water-related energy use are energy efficiency and water conservation strategies. Many water and wastewater agencies are already leading the way through conservation-adjusted business plans, investments in efficient infrastructure, reuse of wastewater, and self-generation of renewable energy; but more work is needed. Achieving industry-wide shifts will require sustained State leadership and new policy and regulatory frameworks that account for water supply, water and energy use, water quality standards with regional flexibility and funding, and effective data collection and analysis. Reducing GHG emissions from the water sector will require close coordination between water agencies and energy agencies. Greater attention will need to be paid to the water-related impacts of land use and development. Most important, the State and local water agencies will need to play a key role in three areas:

- Prioritizing investments in conservation.
- Adopting rate structures and pricing that maximize conservation.
- Promoting less-energy intensive water management, such as a comprehensive groundwater policy.

Additional gains in water conservation, especially use reductions in both agricultural and urban landscape irrigation, are critical not only for meeting GHG emission reduction goals, but also for resilience to more frequent and severe droughts. Many local agencies throughout California have invested in water conservation and water use-efficiency activities. The State should encourage and facilitate local water conservation projects that achieve co-benefits of energy efficiency and greenhouse gas emission reductions.

Establishing a conservation-first policy for water-sector investment and action would help to sustain declining per-capita usage. This policy would be similar to the State's "loading order" policy for energy, which prioritizes investments in energy efficiency ahead of developing new power supplies. The conservation-first policy could be implemented through legislation or joint-agency action. (The State's Energy Action Plan, for example, was jointly approved by the CEC, CPUC, and CAISO).

Pricing policies are another key tool to deter waste, encourage efficiency, and require those who use the most to pay the costs of assuring the water supply. It is important that such policies also protect the ability of low-income households to purchase minimum necessary water supplies. While water rates are set at the local level, the State can use financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes such as water rights applications.

California must also develop policies that thoroughly and accurately reflect the economic, social, and environmental value of water, to ensure the effectiveness of future water management practices, and to evaluate competing water use demands and trade-offs. For example, in the California Water Action Plan, the State proposed a comprehensive groundwater policy to reduce overdraft and energy-intensive pumping from deep underground. This policy will require collaboration between the SWRCB, Department of Water Resources (DWR), Department of Food and Agriculture, and other agencies.

Successfully meeting the water sector goals will also require balancing multiple policy objectives, such as flood protection, sustainable food production, and renewable energy development. Interagency coordination, such as the recent efforts of the SWRCB to develop the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (once-through cooling), shows interagency coordination is possible without a drastic overhaul of regulatory responsibilities. Nevertheless, additional challenges posed by the changing climate and economic pressures to successfully achieve mitigation goals across multiple economic sectors must be addressed. Multiple policy objectives must be balanced across a wide spectrum of State water and climate planning documents, such as the AB 32 Scoping Plan, the Safeguarding California Plan, the California Water Plan, the Delta Plan, the Bay Delta Conservation Plan, and the Integrated Regional Water Management Strategic Plan. The California Water Action Plan provides some guidance on the relationship between the priorities established in these water and climate planning documents by establishing priorities for the next five years.

State agency collaboration and policy alignment requires a foundation of information sharing and feedback. Both agency staff and executives will need to devote more time to inter-agency dialogue to ensure that policy differences are resolved with a full understanding of the consequences of decisions taken. In addition, achieving efficient and aligned policies across agencies may require alterations to existing agency authorities and decision-making procedures.

Key Recommended Actions for the Water Sector

Funding

- DWR and SWRCB to give priority to funding integrated management plans that include robust existing or proposed water and energy conservation and efficiency and measures that achieve GHG emission reductions. Conservation programs should include numeric targets.

Technology

- CEC to implement new water-related energy conservation measures and efficiency standards.
- CPUC to complete water-energy nexus rulemaking by 2016 and to continue implementation of joint water-energy utility efficiency programs and partnerships
- SWRCB and CPUC to incent resource-recovering wastewater treatment projects by 2015.
- SWRCB and RWQCB by 2016 to implement green infrastructure permits to treat and capture urban runoff for local use.

Administration

- As directed by the California Water Action Plan, the DWR, the SWRCB, CPUC, CEC, CDFA, and ARB to guide adoption of GHG emission-reducing policies for water sector investments and action by 2015. Conservation measures and regulations to reduce GHG emissions and maintain water supply reliability during drought periods will be a centerpiece of this administration action.
- As directed by the California Water Action Plan, DWR, SWRCB, CPUC in consultation with the CDFA, to identify and incent implementation of rate structures that accurately reflect the economic, social, and environmental value of water in California while maintaining affordability for basic services.
- As directed by the California Water Action Plan, the SWRCB to develop a comprehensive groundwater management strategy, and the DWR and CDFA to provide technical and financial assistance to exceed SBx7-7 targets.
- SWRCB and RWQCBs by 2016 to modify State and regional water board policies and permits to achieve conservation, water recycling, stormwater reuse, and wastewater-to-energy goals.

Education

- As directed by the California Water Action Plan, DWR, SWRCB, CPUC, CEC, and CAISO to promote water-energy conservation outreach and education.

5. Waste Management[86]

The Waste Management Sector covers all aspects of solid waste and materials management, including the recycling, reuse, and remanufacturing of recovered material; composting and anaerobic/aerobic digestion; municipal solid waste (MSW) thermal operations (waste-to-energy); biomass management (combustion, composting, chip and grind); and landfilling. This sector also includes market development programs, such as the State's environmentally preferable and recycled-content product purchasing program. The primary source of GHG emissions from this sector is the direct emission of methane from the decomposition of organic material in landfills. However, recycling, reuse, and reduction of waste materials will reduce upstream GHG emissions associated with the production and transport of products. Although many of these upstream GHG emissions happen outside of California, California's waste policies can help reduce both local and global GHG emissions and create jobs within the State.

California has a robust waste management system in place, with established programs that reduce air emissions through activities such as gas collection systems from landfills and stringent recycling mandates. California adopted landmark legislation in 1989 (Assembly Bill (AB) 939) that required cities and counties to reduce the amount of waste going to landfills by 50 percent in 2000 and has surpassed this mandate to achieve 66 percent in 2012. This action has resulted in diverting nearly 60 million tons per year of material from landfills to reuse, recycling, composting, and other beneficial uses.[87] These reductions could not have been achieved without the waste industry, local jurisdictions, affected business, and the public working diligently and cooperatively to meet the goal of AB 939. In doing so, we achieved a co-benefit of substantial GHG emission reductions due to the energy savings associated with the use of recovered materials in place of new raw materials.

However, California still disposes about 30 million tons of solid waste in landfills each year. To address this and recognize the role waste management can play in GHG emission reductions, the legislature adopted AB 341 (Chesbro, Chapter 476, Statutes of 2011) in 2011. This legislation set a clear mandate to achieve more significant waste reductions by 2020, setting a goal that 75 percent of the solid waste generated be reduced, recycled, or composted by 2020. It is estimated that achieving the AB 341 waste reduction goal will result in a yearly GHG reduction of about 20 to 30 $MMTCO_2e$.[88]

The initial Scoping Plan identified several activities that would continue to move California forward in enhancing this integrated system for addressing waste-related issues and further reduce GHG emissions from this sector. These activities include landfill methane emission reductions, reduction in waste generation, and shifting waste to more beneficial uses. In 2009, ARB adopted the Landfill Methane Control Measure to further reduce methane emissions from landfills. And, in 2012, CalRecycle adopted the Mandatory Commercial Recycling regulation to further increase recycling programs throughout the State.

ARB approved two resolutions to work with CalRecycle and other stakeholders to characterize emission reduction opportunities for different options for handling solid waste, including recycling, remanufacturing of recovered materials, composting and anaerobic digestion, waste-to-energy, landfilling, and the treatment of biomass. In addition, ARB is to develop a comprehensive approach for the most appropriate treatment of the Waste Sector under the Cap-and-Trade Program, based upon the analysis of emission reduction opportunities.

86 ARB and CalRecycle have prepared six technical papers: Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; Biomass Conversion; Municipal Solid Waste Thermal Technologies; Landfilling of Waste; and State Procurement which are the basis for the information summarized here. The technical papers are available at *www.arb.ca.gov/cc/waste/waste.htm*.

87 This also includes the use of green material as alternative daily cover at landfills and some materials sent to transformation facilities.

88 Most of the estimated emissions benefits will be outside of California, since the majority of the recyclable commodities are currently reprocessed outside the State.

Meeting the AB 341 75 percent recycling goal is the best path forward to maximizing GHG emission reductions from the Waste Management Sector and putting California on the path for even greater GHG emission reductions in the future. In the future, net zero GHG emissions are achievable in a mid-term time frame. By 2050, direct GHG emissions from waste sector activities could be reduced by 25 percent, creating a net negative GHG footprint for the waste sector.

To achieve these goals, California must take greater ownership and responsibility for the waste generated within its borders. Shipping of waste, even recyclable products, to other states or nations is not a viable, long-term, environmentally appropriate waste management practice for California. Furthermore, exporting waste denies California the economic opportunity of significant job growth that would result if these materials were processed and remanufactured in California. While California cannot control exports, implementing the principle of owning our own waste will allow California to develop new, state-of-the-art waste management facilities/system which can be emulated by other states and nations.

Maintaining Momentum

California will need to maximize recycling, composting, and anaerobic digestion (instead of landfilling) and expand current waste management infrastructure to accommodate the increases in recycling and remanufacturing of waste material that is expected. This would mean constructing more composting and anaerobic digestion facilities that can use organics from the waste stream, as well as building more remanufacturing facilities for recyclable commodities such as fibers and resins.

Financing and permitting infrastructure development will be critical elements to achieving the Waste Management Sector goal. Financing, funding, and incentive mechanisms will be needed to support the development of the in-state infrastructure. Mechanisms to be considered will include Cap-and-Trade Investment Plan; loan, grant, and payment programs; Low Carbon Fuel Standard pathways; Public Utility Commission programs (e.g. biogas from anaerobic digestion and Renewable Market Adjusting Tariff); and offset protocols. Actions will also be needed to address permitting challenges and streamlining the multi-agency review of new and expanded infrastructure.

As increasing amounts of materials are diverted and recovered from the landfills, the markets for the recycled, reused, and remanufactured materials must grow. The State can take a leadership role in market development by having public agencies increase procurement of products with low-waste or no-waste attributes. In addition, greater producer responsibility for end-of-life product management, along with product design changes that minimize impacts on human health and the environment at every stage, will be increasingly important.

The State will need to explore opportunities for additional methane control at new and existing landfills either through amendments to the Landfill Methane Regulation and/or moving landfills into Cap-and-Trade or prohibiting/phasing out landfilling of organic materials.

The comprehensive nature of the waste sector has important ramifications for other focus areas. For example, efforts to divert green waste or biomass from the waste stream complements goals within the energy sector to further develop biomass resources for renewable electricity generation. Expanding agricultural waste diversion through composting and anaerobic digestion may affect policies within the agricultural focus area. Efforts to expand urban-based waste recycling and reuse programs may have implications for the transportation, fuels, and land use focus area.

Enhanced collaboration with State and local agencies is necessary, as California's waste-related issues are diverse and interconnected. Determining the best use of recycling alternatives, examining ways to increase the use of collected wastes and expanding their potential markets, providing funds to build needed infrastructure, and undertaking additional research are all important steps to reach the State's 2050 GHG emission goals.

In summary, to achieve the vision for the waste management sector, certain overarching actions are recommended. Actions to identify opportunities to further expand and maximize various waste management alternatives with California's own borders will need to be pursued. This could include the implementation of regulatory or statutory actions to phase out organic materials at landfills; including landfills in the Cap-and-Trade Program; and implementation of "best management" practices. Financial incentives to build adequate in-state infrastructure and incentivize activities to accomplish GHG and waste reduction goals are critical. Collaboration with other agencies, districts, and jurisdictions to streamline the permitting process and address conflicting requirements, including cross media issues, will permit a sustainable waste management system to grow in California. Additional research will also be needed to better characterize emissions for various materials and processes, and identify the best waste management alternatives.

Key Recommended Actions for the Waste Sector

- ARB and CalRecycle will lead the development of program(s) to eliminate disposal of organic materials at landfills. Options to be evaluated will include: legislation, direct regulation, and inclusion of landfills in the Cap-and-Trade Program. If legislation requiring businesses that generate organic waste to arrange for recycling services is not enacted in 2014, then ARB, in concert with CalRecycle, will initiate regulatory action(s) to prohibit/phase out landfilling of organic materials with the goal of requiring initial compliance actions in 2016.
- ARB and CalRecycle will identify and execute financing/funding/incentive mechanisms for in-State infrastructure development to support the Waste Management Sector goals. Mechanisms to be considered will include the Cap-and-Trade Investment Plan; loan, grant, and payment programs; LCFS pathways; CPUC proceedings (e.g. biogas from anaerobic digestion and Renewable Market Adjusting Tariff); and offset protocols.
- ARB will lead a process of identifying and recommending actions to address cross-California agency and federal permitting and siting challenges associated with composting and anaerobic digestion. As the first step, ARB convened a working group in 2013 made up of representatives from CalRecycle, SWRCB, and local air districts to identify challenges and potential solutions. A working group report will be released in mid-2014.
- ARB will explore and identify opportunities for additional methane control at new and existing landfills, and increase the utilization of captured methane for waste already in place as a fuel source for stationary and mobile applications. If determined appropriate, amend the Landfill Methane Regulation and/or move landfills into the Cap-and-Trade Program (2016/17).
- ARB and CalRecycle will develop new emission reduction factors to estimate GHG emission reduction potential for various recycling and remanufacturing strategies. To the extent data are available, these factors will include upstream and downstream emissions impacts.
- CalRecycle and the Department of General Services will need to take the lead in improving the State procurement of recycled-content materials through the State Agency Buy Recycled Campaign reform. Recommended improvements need to be identified by 2014, along with a plan for implementing the identified improvements.

6. Natural and Working Lands (Formerly Referred to as Forest Sector)

Three-quarters of California's landmass comprises biologically diverse landscapes such as forests, woodlands, shrublands, grasslands and wetlands. In this section's discussion, working lands includes rangelands but not agricultural croplands which are addressed in the Agriculture Sector. The initial Scoping Plan included a measure on sustainable forests and also identified additional strategies such as urban forestry and fuels management. This Scoping Plan update recognizes the key role that forests and all natural and working lands must play in meeting California's GHG emission reduction goals.

Natural and working lands act as both a source of GHG emissions and a carbon sink that removes CO_2 from the atmosphere. For example, vegetation growth and associated carbon sequestration in response to favorable growing conditions in one year can be followed by reduced growth or mortality during extended periods of drought. Emissions from wildfire, pest, and disease, are all natural ecosystem processes that can fluctuate from year to year and greatly influence the relationship between source and sink. However, when sustainably managed, the potential for natural and working lands to reduce GHG emissions and sequester carbon is significant and will be critical to reaching California's long-term climate goals.

Efforts to reduce GHG emissions and enhance carbon sequestration on natural and working lands also have significant economic, social, and environmental co-benefits, and can aid progress on efforts to prepare for climate change risks. A few key co benefits include protection of water supply and water quality, air quality, species habitat, recreation, jobs, wood and related products, flood protection, nutrient cycling and soil productivity, reduced heat-island effect, and reduced energy use. However, to ensure resilience, carbon management of these lands must be integrated with a broader suite of resource management objectives for those lands.

The initial Scoping Plan included a Sustainable Forest Target. The goal of this target was to maintain net carbon sequestration on forest lands. This was to be achieved using the mechanisms provided by the Forest Practice Rules, timberland conversion regulations, fire safety requirements, forest improvement assistance programs, and the California Environmental Quality Act (CEQA), which requires avoidance or mitigation of impacts affecting forest site productivity or forest carbon losses to conversion. The initial Scoping Plan also identified other opportunities to realize additional GHG emission reductions and increase sequestration, including the following:

- Preventing the conversion of forestlands through publicly and privately funded land acquisitions.
- Maintaining and enhancing forest stocks on timberlands through forest management practices subject to the Forest Practice Act.
- Planting trees on lands that were historically covered with native forests.
- Establishing forest areas where the preceding vegetation was not forest.
- Planting trees in urban areas.
- Using urban forest wood waste for bioenergy.
- Reducing vegetative fuels that could feed wildfires and using this waste for bioenergy.

The Board of Forestry and Fire Protection (BoF) has been evaluating the adequacy of existing forest regulations and programs for achieving GHG emission reductions and ensuring carbon sequestration on forest lands. In 2010, amendments to CEQA guidelines led to the requirement that timber harvest proponents subject to State regulations must analyze GHG emissions when applying for CAL FIRE permits.

The initial Scoping Plan recognized the need for continued research to improve estimates of ecosystem carbon stocks and GHG flux associated with stock change on forests and other natural lands. In 2011, ARB contracted with researchers from UC Berkeley to develop a new

methodology for assessing carbon stock changes for all California's lands except agricultural and urban areas. The researchers have developed a new emissions assessment approach based on field measurements (Forest Inventory and Analysis data) and satellite remote sensing data and methods. The methodology includes an emissions assessment of forests, woodlands, grasslands, shrublands, and wetlands.[89]

Healthy forests and lands returning to forest are an important source of carbon sequestration. The UC Berkeley research is showing, however, that loss of forests and other natural lands through fire, natural ecosystem succession and conversion of forests and woodlands to other uses represent significant CO_2 release, potentially significantly greater than previously estimated and may outpace carbon sequestration, possibly by substantial amounts. This information underscores the importance of managing our forests and other natural and working lands to maximize the net benefits—increasing sequestration while reducing conversion and carbon stock losses, and maximizing associated co-benefits.

Application of the new research methodology will enable the monitoring of changes on the land over time and periodic quantification of the GHG flux associated with changes in ecosystem carbon stocks. As source data improves and methods are refined, ARB's GHG inventory for forests and other lands will be updated. This new inventory information can help identify the steps needed to reverse adverse trends and inform efforts to manage natural and working lands for net climate benefits.

The methodology developed by UC Berkeley does not include tree-covered urban areas. However, CAL FIRE, in conjunction with the U.S. Forest Service and researchers at UC Davis, is also developing GHG inventory data for urban forests and is continuing to refine and update those data over time. Improvements to ongoing GHG reporting systems will include refinements to methods and incorporation of additional relevant data sets (such as information on vegetation, forest stand treatments, and other activities) that are collected by CAL FIRE and other agencies.

On September 11, 2012, Governor Brown signed Assembly Bill 1492 (AB 1492; Blumenfield, Chapter 289, Statutes of 2012), with the first major changes in forest sector legislation in ten years. Among other things, AB 1492 set into motion a fee on certain types of lumber and wood products in California that now help fund forest management programs related to timberlands. One of the provisions of this new law is the requirement for the State to evaluate ecological performance measures, which are likely to include an evaluation of practices that may directly or indirectly affect GHG emissions.

Maintaining Momentum

While ongoing efforts are being made to reduce GHG emissions and increase carbon sequestration in California's forests, additional work is necessary, and incorporating other land types into our planning will become increasingly important as we move beyond 2020. With appropriate investments and sound science-based policy, natural and working lands in California can provide a tremendous opportunity to meet the State's climate goals. Over time, efforts in the Natural and Working Lands Sector will achieve many other important public and environmental benefits, such as protection of water supply and quality, air quality, and species habitat, as well as providing recreational opportunities and jobs.

Timing is critical for actions in this sector. Activities to enhance carbon storage on natural and working lands, such as reforestation or restoration, will require time to fully realize carbon benefits. For example, planting trees today will maximize their sequestration capacity in 20 to 50 years. In addition, trees in urban environments, or "urban forests," provide significant shading

89 Battles, J., Gonzalez, P., Robards, T., Collins, B., Saah, D., Jan 2014, California Forest and Rangeland Greenhouse Gas Inventory Development, Final Report, California Air Resources Board Agreement 10-778; *www.arb.ca.gov/cc/inventory/sectors/forest/forest.htm*

and other cooling benefits. As the trees mature they reduce urban temperatures and energy needs. Near-term investments in activities such as planting trees will help us reach our 2020 limit, but will also play a greater role in reaching our mid-term and longer-term 2050 targets especially if action is taken in the near-term.

Some actions to reduce emissions and enhance carbon storage in the long-term may result in temporary, short-term reductions in carbon sequestration. For instance, actions taken to address forest health concerns or to reduce wildfire risks may result in temporary reductions in carbon stock, but they are necessary to maintain healthy forests that are more efficient at GHG sequestration and more resilient to future climate conditions. It's important to manage our forests to maximize net climate benefits, increasing sequestration while reducing losses due to fire or other processes, while also considering the broader range of environmental services that forests and other natural lands provide.

There may also be additional benefits beyond carbon that can only be realized if actions are taken early enough. For instance, in some cases restoring tidal wetland can offer flood protection that is able to keep pace with sea level rise through the growth of root mass over time, but such naturally growing flood protection enhancements are only possible if restoration activities are initiated early.

Through implementation of GHG policies, actions, and strategic investments identified below, efforts to enhance, protect, and conserve natural and working lands in California can result in important climate benefits, as well as a more resilient California that is better prepared for climate risks such as more frequent and severe wildfires, changing water availability, and stressors on species and natural communities.

Research and Emission Inventory Updates

Inventory development and improvement are critical for informing carbon management activities in California. Recently developed tools will enable ARB to generate geospatially explicit estimates of ecosystem carbon stocks and GHG flux associated with stock change across a variety of land categories. Though additional work is needed, these tools, along with regularly updated input datasets will allow tracking of changes over time and provide a new method to update the GHG inventory.

The sources and methods for quantifying ecosystem carbon and GHG flux in this sector are complex. Additional work is needed to evaluate the data provided by the UC Berkeley research, to incorporate additional new data, and to identify further research needed to expand use of these tools. Continued refinements will advance carbon quantification, attribution of GHG flux by disturbance process, and reduce uncertainty, all of which will help inform effective carbon management activities. There is also a need to prioritize and conduct additional research on outcomes of specific practices to maximize carbon uptake on natural and working lands in California.

Integrating Biological Systems

Natural and working landscapes in California are composed of widely varied, vibrant, and often interconnected biological systems. Moving forward, it is important to begin looking at these lands in a more holistic and integrated way to ensure that we maximize opportunities to achieve biological carbon benefits across the range of California's natural lands, while also ensuring the health and resiliency of these lands to provide ongoing ecosystem services.

Forest Planning and Actions

California forests must be managed to ensure that they provide net carbon storage even in the face of increased threats from wildfire, pests, disease, and conversion pressures. Quantitative planning targets must be set to increase net forest carbon storage in California in the near-term, mid-term, and by 2050, while ensuring forest resilience, health, and continued ecosystem

services. Forest carbon inventory and assessments should be continually maintained and refined to support this effort, and appropriate measures, funding, and incentives must also be established.

Specific actions to meet these planning targets for increasing carbon storage in California forests will be laid out in a "Forest Carbon Plan" (Plan). The Plan will be developed by a joint inter-agency workgroup and will necessitate engaging our federal partners with respect to federal lands in the State. The Plan should also include input from expert resources and stakeholders such as academia, non-governmental organizations, working forest owners, and local planning groups, to inform policy decisions. Additionally, the Plan should work synergistically with other State planning policies where GHG emission reduction strategies and co-benefits intertwine such as in the Water Action Plan, State Wildlife Adaptation Plan, and Safeguarding California. A resource economics study may be necessary to support the development of the Forest Carbon Plan; funding for such a study would be needed.

The Forest Carbon Plan will, at a minimum, set mid-term and long-term planning targets; identify actions to meet those targets; and provide recommendations on funding those actions. Development of the Plan should include a review of Forest Practice Regulations and recommendations for best management practices and potential additional regulatory measures or amendments needed to minimize GHG emissions and enhance carbon storage associated with silvicultural treatments. For example, a requirement for Sustained Yield Plans to demonstrate that activities not only maintain the current level of carbon sequestration, but actually increase carbon sequestration over the 100-year planning horizon.

Funding recommendations in the Plan should include but not be limited to the following:

- Recommendations regarding the development and implementation of market-based mechanisms applicable to large forest land owners for the purpose of ensuring that forests in California provide net carbon storage.
- Recommendations regarding the development and implementation of a competitive grant program.
- Recommendations regarding types of climate investments that might be supported by varying levels of funding support from Cap-and-Trade auction revenues or other sources.
- Recommendations regarding the process for dedicating a portion of Yield Tax Revenue to fund forest climate investments.
- Recommendations pertaining to property tax restructuring or other financial incentives to attract more interest in active forest management by nonindustrial timberland owners.

Another forest action is to incentivize the sustainable use of biomass obtained from forest management practices to produce energy. This strategy diverts raw materials from being burned in open piles, and reduces criteria and GHG pollutant emissions. Open burn piles create particulate emissions, which can exacerbate health problems and interfere with attaining State and federal ambient air quality standards. In addition, open burning contains black carbon, which is a short-lived climate pollutant (SLCP). As discussed in Chapter II, SLCPs have a shorter lifetime in the atmosphere and have a higher pound-for-pound warming potential than CO_2, and as such, during these shorter lifetimes they are very potent. Because SLCPs are removed from the atmosphere rather quickly, reducing their emissions results in immediate climate and air quality benefits. Cross-sector coordination is needed between the energy, waste, water, natural and working lands, and agriculture focus groups to develop recommendations for addressing economic, infrastructure, and regulatory hurdles regarding the input of bioenergy into the electricity grid from both small-scale and utility-scale biomass energy facilities.

Development of a carbon life cycle analysis for wood products could also be considered. When utilizing wood products for construction, manufacturing, and sale of goods in California, the location of the initial raw wood should be considered along with an analysis of the associated

carbon emissions from the processing and transport of wood products through the various steps of the supply chain. Guidelines could be established that would identify and incentivize wood products that reduce carbon emissions–taking into account GHG emissions from transportation to the mill, from the mill to the production facility, and finally to the retailer. For example, wood harvested in California and transported and utilized locally for construction and manufacturing would have a lower carbon impact than wood that has been harvested and manufactured outside the State, shipped from overseas, or processed and reintroduced within California as a finished wood product.

Rangelands and Wetlands Planning and Actions

In the absence of comprehensive California rangeland and wetland carbon data, these lands should be protected from conversion pressures and degradation that could result in significant carbon emissions. In addition, restoration and improved management practices to increase carbon storage should be incentivized. This is true particularly where such enhancement, protection, and conservation action provide other important climate benefits, such as improving watershed conditions and flood protection, and providing habitat and connectivity for climate-stressed species.

Land Use Planning to Enhance, Protect, and Conserve Lands in California

As described under the Agricultural Sector, an integrated and coordinated approach to local land use planning that considers all land types is important in meeting the State's GHG reduction goals. Urban, natural and working lands, and agricultural croplands within and across jurisdictions must all be considered to create interconnected land areas and ecosystems. Local and regional land use planning actions and policies need to more fully integrate and emphasize land conservation and avoided conversion of croplands, forests, rangelands, and wetlands—as well as expansion and promotion of urban forestry, urban agriculture, and green infrastructure.

Urban Forests

Expansion and support is needed for urban forest programs, particularly in environmental justice communities. Urban forests can significantly reduce the disproportionate environmental impacts on California's environmental justice communities through increased green infrastructure investments that reduce GHG emissions. These investments benefit communities and result in environmental benefits such as reduced storm water runoff and clean air; health benefits from motivating active transportation and reducing urban heat island effects; and economic benefits such as reduced energy demand through cooling and increased land values. Utilizing local groups, such as the Local Conservation Corps, to implement urban forest and urban greening projects in these areas can provide dual benefits by also providing experience, training, and opportunity for at-risk youth.

Funding Needs

Funding is critical to address the needs in this sector, yet it is far below historic levels and in some cases does not exist. Outcomes of actions on natural and working lands often occur on a decadal scale. Action within the next ten years is critical so long-term benefits can be fully realized in the 2050 time frame. Funding sources must be identified, particularly where funds from existing sources can be leveraged effectively.

Funding across the sector is needed for further inventory improvements, research on effective GHG reduction and sequestration practices, and direct on-the-ground activities known to reduce GHG emissions and increase sequestration.

To further define and describe these needs, a natural and working lands climate investment working group will be convened to produce a report that outlines funding needs and opportunities for the Natural and Working Lands Sector as a whole. The GHG inventory, Forest Carbon Plan, local land use planning efforts, and other statewide efforts should be considered in development of the report.

To the extent feasible, the report should include strategic prioritization guidelines for investments in forests, rangeland, or wetlands. As different governmental entities and stakeholders actively manage forest, rangelands, and wetlands, separate prioritization guidelines should be developed for each land type and for the sector as a whole, if possible.

Key Recommended Actions for Natural and Working Lands

- The California Natural Resources Agency (CNRA) and CalEPA will convene an inter-agency forest climate workgroup to prepare and publish a "Forest Carbon Plan" in 2016. The Forest Carbon Plan will:
  - Set quantitative near-term, mid-term, and long-term planning targets to ensure an increase in net forest carbon storage in California commensurate with the State's long-term GHG reduction goals, and in light of recent research that suggest that forests in California may be a source of GHG emissions rather than a carbon sink.
  - Identify near-term and long-term actions necessary to meet quantitative planning targets while ensuring forest resilience and health, ecosystem services, conservation of the forest land base, and continued economic opportunities.
  - Evaluate GHG emission and carbon sequestration trends for different forest land ownership types and consider sector sub-targets for each type.
  - Develop specific recommendations regarding approaches for funding actions to ensure that forests in California provide net long-term carbon storage.
- In 2016, through AB 1504, CAL FIRE and BOF will evaluate methods to develop a life cycle analysis to track carbon in wood products; this work should be coordinated with ARB's forest inventory and support the Forest Carbon Plan.
- The Bioenergy Interagency Working Group will continue to work with stakeholders and relevant agencies to:
  - Strengthen, refine, and implement actions contained in its Bioenergy Action Plan related to use of forest biomass.
  - Evaluate the potential biomass energy generation capacity.
  - Develop methods to quantify biomass life-cycle GHG flux.
- In 2015, OPR, CNRA, CalEPA, CDFA, California Department of Fish and Wildlife (CDFW), CAL FIRE, and ARB will convene an inter-agency workgroup to engage local and regional land use planning agencies in establishing a coordinated local land use program. The program will set planning targets that identify, prioritize, and incentivize land conservation; increase urban forestry canopy cover; bolster development of green infrastructure; and limit the conversion of both agricultural croplands and natural and working lands.
- In 2015, CNRA, CalEPA, CDFA, CDFW, CAL FIRE and ARB will convene a natural and working lands climate investment working group to draft a report outlining funding needs, opportunities, and priorities for the Natural and Working Lands Sector.
- Expand urban forestry and green infrastructure programs and investments, particularly in California's environmental justice communities.
- Continue to analyze the UC Berkeley research methodology and data to develop GHG inventory updates, incorporate more recent data into the newly developed tools for carbon quantification, and invest in and expand monitoring and research to reduce uncertainty in carbon quantification and attribution of GHG flux by disturbance process.

7. Short-Lived Climate Pollutants

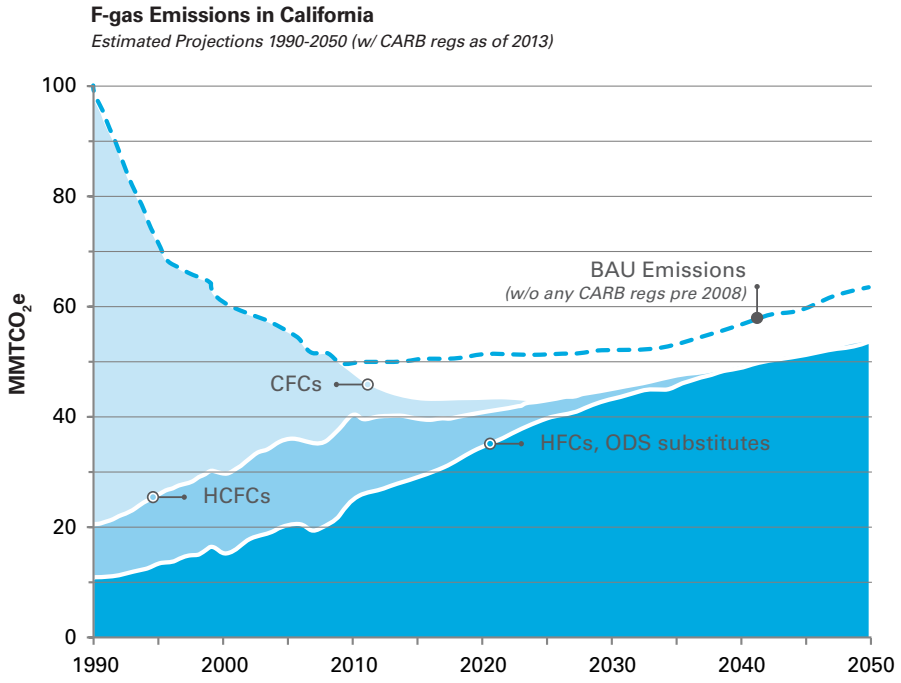
Mitigation of short-lived climate pollutants (SLCPs)—which include black carbon, methane, tropospheric ozone, and some hydrofluorocarbons (HFCs)—produces immediate climate benefits and is an important complement to efforts to reduce emissions of CO_2. Many short-lived climate pollutants are already regulated by ARB, either as part of the air quality and toxics program or under the Scoping Plan. For example, black carbon levels in California will be reduced by 95 percent from the late 1960s to 2020, primarily due to diesel controls and burning restrictions. Peak urban ozone levels have also been reduced by more than 75 percent since the 1960s; however, substantial further reductions are needed to comply with federal requirements to meet the National Ambient Air Quality Standard by 2032. ARB is mitigating methane and HFCs from various sources through the implementation of control measures identified in the initial Scoping Plan and will develop a more aggressive short-lived climate pollutant strategy by 2015 that will include an inventory of sources and emissions, the identification of additional research needs, and a plan for developing necessary control measures. ARB will consult with external experts in the development of this strategy.

Several recent analyses of atmospheric measurements suggest that actual methane emissions may be 1.3 to 1.7 times higher than estimated in ARB's emission inventory. California and federal agencies, universities, and national laboratories have put into place a comprehensive set of research studies to determine the sources of these higher-than-expected methane emissions, and whether additional controls are technologically feasible and cost-effective. In March 2014, the Obama Administration released the Climate Action Plan - Strategy to Reduce Methane Emissions[90] identifying actions to improve methane emission estimates and develop methane emission control measures. The Strategy identifies key agencies that will be responsible for evaluating and implementing methane reduction strategies for various sources including landfills, agriculture operations, coal mines, and oil and gas production. Strategies that address methane emissions in this Update are identified in the preceding sector discussions on energy, agriculture, and waste.

Short-lived climate pollutants have a subcategory of compounds that are considered to have an even higher significance on climate change on a per-ton emission basis than other SLCPs. These compounds are called high global warming potential (GWP) gases. High-GWP gases are those that, on a per-ton basis, contribute to global warming at a level many times greater than carbon dioxide (GWPs of 150 or higher). These gases are manufactured, have no natural sources, and have been in use for decades, primarily in refrigerators, air conditioners, and foam insulation. A majority of the emissions are comprised of hydrofluorocarbons (HFCs), with a smaller percentage from perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). Although emissions of high-GWP gases are only three percent of today's statewide GHG inventory, they are the fastest-growing GHG source in California as HFCs are replacing ozone-depleting substances (ODSs) in response to the Montreal Protocol mandates. Significant efforts will be needed to control these emissions as the ODSs are phased out. The ODSs are primarily chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), and all the fluorine-containing gases are collectively known as F-gases. Figure 7 shows California's F-gas emission trends from 1990 to 2050.

90 *www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf*

Figure 7: Fluorinated gas (F-gas) Emissions in California (1990–2050)



Note: The blue dashed line represents business-as-usual F-gas emissions if no CARB regulations had been adopted to reduce high-GWP emissions. The dark blue area represents business-as-usual (BAU) emissions, including reduction measures adopted as of December 2013.

Due to the phase-out of ODSs, total F-gas emissions have been reduced by 57 percent since 1990. However, HFCs continue to increase as they replace the ODSs that are banned by the Montreal Protocol. Even with the current regulations that are in place, HFC emissions are expected to increase by about 40 percent (from 18 to 25 $MMTCO_2e$) between 2012 and 2020. With no additional control measures, HFC emissions in California are expected to more than double by 2050, to 43 $MMTCO_2e$ annually, accounting for approximately half of California's long-term GHG emission target.

While high-GWP gases are not a discrete sector of California's economy, the Scoping Plan addressed them as a sector to organize and track emissions, sources, and emission reduction strategies. The focus of the Scoping Plan measures was primarily on HFC emission reduction programs. These measures focused on two central themes to achieve five $MMTCO_2e$ of GHG emission reductions by 2020: (1) use of lower-GWP alternatives for certain consumer products and new motor vehicle air conditioning systems, and (2) avoiding releases of currently used high-GWP gases, using gas recovery options, such as those for electrical transmission and particle accelerators, and leak tightness specifications.

Implementation of the Scoping Plan measures has reduced emissions from a variety of sources. The biggest reductions of high-GWP gases are expected to come from ARB's Refrigerant Management Program, which requires facilities with refrigeration systems to inspect and repair leaks, maintain service records, and in some cases, report refrigerant use. Significant reductions are also expected to come from a motor vehicle air-conditioning (AC) credit program for vehicle models 2017 and beyond. This measure is part of the Low Emission Vehicle (LEV III) regulation that has been aligned with a new federal Clean Cars program.

In spite of ARB efforts, significant obstacles remain for further reductions of HFCs, due to the diverse nature of sources. Substantial progress has been made in recent years in the development of low-GWP alternatives in the refrigeration and foam industries that can achieve significant reductions in the high-GWP sector. Low-GWP refrigerants and insulating foam are currently under evaluation to better understand their technical feasibility and cost-effectiveness in various applications. Based on further analysis, ARB may develop programs to require low-GWP insulating foam materials and refrigeration systems that use either low-GWP alternatives or significantly reduced amounts of HFCs.

California's efforts can help support a national or international phase-down of HFC production and consumption. On June 8, 2013, the United States and China entered into a preliminary agreement to phase down the production and consumption of HFCs between the two countries. For the first time, the United States and China will work together and with other countries to use the expertise and institutions of the Montreal Protocol to phase down the consumption and production of HFCs, among other forms of multilateral cooperation.

Maintaining Momentum

There are several potential approaches to further reduce high-GWP F-gases. These include:

High-GWP F-gas Phasedown

California to work with the U.S. EPA to establish national standards in alignment with the European Union (EU) proposed F-gas phasedown of HFC production and import to just 21 percent (based on CO_2-equivalents) of baseline annual usage (years 2008 – 2011) by the year 2030. Some sector-specific prohibitions are included within the proposed EU phasedown, including a ban on refrigerants with a GWP greater than 2,500 used in new equipment.

Low-GWP Requirements

Low-GWP substitutes for ODSs and HFCs are becoming increasingly feasible and cost-effective. As such, it will be vital to require that low-GWP compounds be used for commercial refrigeration and air conditioning, residential appliances and air conditioning, insulating foam, motor vehicle air conditioning, transport refrigeration, aerosol propellants, metered dose inhalers, solvents, fire suppressants, sulfur hexafluoride uses, and structural pesticide fumigants if California is to meet its mid-term GHG goals and long-term GHG emission reduction goal of 80 percent below 1990 levels by 2050.

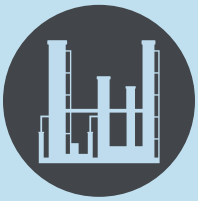
ODS Recovery and Destruction

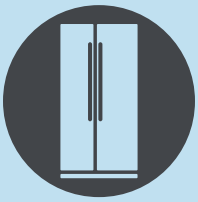
The Montreal Protocol has reduced ODS emissions significantly (by almost 60 percent) by reducing the production and consumption of ODSs. However, it appears that end-of-life emissions from legacy equipment are still significant. Due to higher demand and therefore higher value of recovered ODSs, there is currently less incentive for ODS destruction. More than 80 percent reduction in ODS emissions (approximately 20 $MMTCO_2e$) can be obtained by 2030 by incentivizing recovery and destruction of ODSs at the end-of-life. This can be done by a combination of strategies, including adjustments to current ODS destruction protocols, implementing a mitigation fee, and/or using cap-and-trade revenue to help pay for higher costs.

High-GWP Fee

An upstream mitigation fee on sales of high-GWP gases would incentivize a faster transition to low-GWP substitutes, and could further incentivize improved refrigerant recovery practices. The fee would also be applied to sales or import of equipment pre-charged with high-GWP gases. The mitigation fee would complement rather than replace downstream high-GWP regulations currently in effect or being developed. As sources comply with regulatory measures, affected entities would reduce their emissions and therefore the fees they would need to pay. A high-GWP fee would address high-GWP gases in a consistent manner, on a carbon dioxide equivalent basis, and serve to change behavior, induce new low-GWP alternative products, and provide revenue that can be used to mitigate GHG emissions.

Key Recommended Actions for Short-Lived Climate Pollutants





- Develop a comprehensive strategy for mitigation of short-lived climate pollutants by 2015.
- Continue diesel controls that will reduce black carbon emissions by 95 percent from the late 1960s to 2020.
- Reduce emissions of smog-forming pollutants by about 90 percent below 2010 levels by 2032 to meet the National Ambient Air Quality Standard for ozone.
- Create a collaborative agreement with the U.S. EPA to establish national standards in alignment with the European Union (EU) proposed F-gas phasedown of HFC production and importation to just 21 percent (by CO_2-equivalents) of baseline annual usage (years 2008-2011) by the year 2030.
- Require low-GWP gases where feasible and cost-effective.
- Incentivize recovery and destruction of ODSs at the end-of-life by a combination of strategies, including adjustments to current ODS destruction protocols, and/or implementing a mitigation fee.
- Set an upstream mitigation fee on sales of high-GWP gases and sales or import of equipment pre-charged with high-GWP gases.

8. Green Buildings

Buildings represent the second largest source of statewide GHG emissions, when accounting for electricity, natural gas, and water consumption. However, there are additional GHG emissions related to buildings that have not yet been fully accounted for as part of the Statewide GHG emission inventory. For example, additional GHG emissions could be accounted for under a lifecycle emissions analysis approach such as estimating emissions resulting from the mining, harvesting, processing, and transportation of materials used to construct new buildings, as well as products consumed over the life of a building. The siting and integration of buildings into communities may also affect transportation patterns and infrastructure needs and result in GHG benefits. Green buildings are designed, constructed, operated, and maintained to maximize energy efficiency, conserve water, and minimize waste. They also are strategically located to encourage people to walk, bike, or take public transit rather than drive cars.

Green buildings offer a comprehensive approach to support California's climate change goals across multiple sectors, including energy, water, waste, and transportation while protecting the environment and public health. Green buildings utilize an integrated process to improve the design and construction of new buildings, as well as to retrofit, maintain, and operate existing buildings. By supporting current initiatives and expanding the long-term focus toward zero carbon buildings, green buildings represent a fundamental shift toward a cross-sector and integrated climate policy framework. In the last five years, California has solidified its commitment to green building; leading the way with State buildings, improving building standards, continuing to raise the bar with voluntary programs at the local level, and greening existing buildings.

Leading the Way with State Buildings

Governor Brown took a leadership role by signing Executive Order B-18-12 in April 2012. The Executive Order directs State agencies and departments to take immediate action for state government buildings to serve as models for green buildings. New and renovated State buildings shall achieve Leadership in Energy and Environmental Design for New Construction (LEED-NC) "Silver" certification or higher. All existing State buildings over 50,000 square feet shall complete LEED for Existing Buildings: Operations and Maintenance (LEED-EB: O&M) certification by 2015. In addition, the Order provides that 50 percent of new State facilities beginning design after 2020 shall be zero net energy (ZNE) buildings, and all new State buildings and major renovations starting design in 2025 shall be ZNE buildings. Already, over 100 State buildings have been able to achieve LEED certification. Nearly half of those certifications are for LEED-NC, 35 percent are for LEED-EB: O&M, and about 20 percent are certified to the LEED for Commercial Interiors (LEED-CI) rating system.

In addition, by the end of 2014, there will be 46 megawatts of on-site solar photovoltaic systems at State facilities, plus about 33 megawatts at University of California campuses, and 11.3 megawatts at California State University campuses.

California Green Building Standards

Reducing GHG emissions from construction is being accomplished through continuous updates to the California Green Building Standards (CALGreen) Code. Originally adopted in 2008, the CALGreen Code included all voluntary standards that went beyond the basic building code requirements and introduced new standards for reducing water use, provisions for reducing and recycling construction and demolition waste, criteria for site development to locate buildings near public transit, and measures for improving indoor air quality to protect the health of building occupants. In 2010, the CALGreen Code became mandatory on a statewide basis. The 2010 code, as amended, included provisions for additions and alterations for non-residential buildings, but it still only applied to new construction for low-rise residential buildings. For the 2013 code, effective January 2014, the scope of the CALGreen Code was expanded to all residential

buildings, including high-rise residential, as well as to additions or alterations with increases in conditioned space. In addition to mandatory standards, the CALGreen Code still includes voluntary standards, also known as Tiers, that offer model building code language available for local adoption.

Voluntary Programs at the Local Level

Local governments are helping to reduce GHG emissions as they adopt green building standards that include targets to exceed minimum State building standards for new construction. Over 100 local governments have adopted "beyond code" green building standards. Twenty of those cities adopted building standards to exceed the Building Energy Efficiency Standards by 15 or 30 percent; IOUs supported the adoption of these local "reach" energy standards through technical analysis and funding, as overseen by the CPUC. About 50 cities and counties have standards exceeding the minimum CALGreen Code Tiers. Over 60 local governments have mandated all new construction to achieve third-party green building certification, such as the GreenPoint Rated program and the LEED rating system. Similarly, school districts are pursuing high performance standards for greening public schools. About 40 school districts have mandated minimum Collaborative for High Performance Schools (CHPS) certification for all new construction and major modernization. Since 2008, nearly 200 schools in California have been recognized as CHPS schools.

The State's higher education systems are also leaders in designing and constructing green buildings on their campuses. For example, the University of California system has taken a proactive role in reducing GHG emissions in its buildings and in 2013; President Janet Napolitano declared an initiative for the University of California to achieve carbon-neutrality in its operations by 2025.[91] As of 2011, the California State University system had 36 buildings that were LEED certified with an additional ten buildings expected to qualify for some level of LEED certification.[92] Finally, California's Community Colleges have made remarkable progress toward conserving energy and making their campuses more energy efficient.[93]

Greening Existing Buildings

While building standards for new construction, additions, and alterations are useful to reduce the impacts of climate change, major renovations and sustainable operation of existing buildings offer the greatest potential to reduce building-related GHG emissions. Over 500 buildings have been certified to the LEED-EB: O&M rating system, which certifies that a building's operations follow rigorous green building standards and practices. To maintain momentum for greening existing buildings, progressive programs that accelerate the uptake of proven strategies are needed to reduce not only energy impacts, but also water, waste, and transportation impacts of the existing building stock. To this end, California must begin to develop a process to implement a portfolio of green building requirements to reduce GHG emissions at time of sale or using other trigger mechanisms.

Maintaining Momentum

Zero Net Carbon Buildings

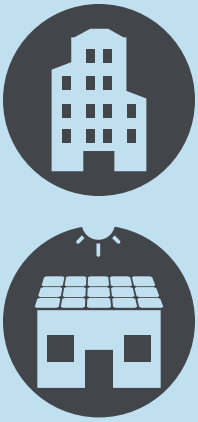
Zero net carbon buildings will be key as we continue to pursue an integrated approach to reduce new and existing building-related impacts that combine climate and air quality programs. To this end, the State will be developing new emission reduction programs for State buildings, schools, homes, and commercial buildings. It will be essential to expand upon the Energy Sector zero net energy building goals and establish goals to achieve zero net carbon buildings. Achieving these goals would result in zero net carbon emissions over the course of a year from all GHG emission

91 *http://sustainability.universityofcalifornia.edu/documents/carbon-neutrality2025.pdf*.
92 *www.calstate.edu/pa/documents/CSU_Sustainability_Report_2011.pdf*
93 *http://extranet.cccco.edu/Portals/1/CFFP/Sustainability/BOG_Energy_Sustainability_Policy_FINAL.pdf*

sources associated, directly and indirectly, with the use and occupancy of buildings. Zero net carbon buildings could utilize high-performance design solutions, generate renewable energy and heating on-site or locally, and employ other techniques to eliminate or offset GHG emissions from all GHG impacts (i.e., energy, water, waste, and transportation) associated with a building. Zero net carbon buildings are the next generation of buildings and could contribute significantly to achieving our long-term GHG emission goals.

The key actions summarized below would support the State's efforts to realize the 2020 emission reduction limit while helping to drive California toward developing and implementing additional strategies to achieve emission reductions from green buildings.

Key Recommended Actions for Green Buildings



Develop a comprehensive GHG emission reduction program for new construction, existing building retrofits, and operation and maintenance of certified green buildings. Program development to be completed by end of 2017 and incorporate the following principles:

- Achieve Executive Order goals for State buildings.
- Build on California's existing zero net energy building goals and activities by 2015.
- Continue research activities to better quantify GHG emission reduction potential of certified green buildings by 2016.
- Strengthen the next two triennial editions (2016 and 2019) of the Green Building Standards Code with mandatory provisions that reduce GHG emissions by 2017 and 2020 respectively.
- Build on AB 758 Action Plan implementation activities, and explore opportunities to implement a portfolio of green building retrofit requirements at time-of-sale or other trigger mechanism by 2017.
- Explore methodologies to quickly but accurately quantify direct and indirect GHG emissions from new and existing buildings by 2017.
- By 2017, establish target dates and pathways toward transitioning to zero net carbon buildings that expand upon and complement ZNE goals.
- By 2018, implement a mechanism to track progress toward achieving statewide green building goals.

9. Cap-and-Trade Regulation

The Scoping Plan recommended the development of a California Cap-and-Trade Program that links with other Western Climate Initiative partner programs to create a regional market system. On January 1, 2013, ARB launched the second-largest GHG Cap-and-Trade Program in the world. The Cap-and-Trade Regulation ensures progress toward the near-term 2020 statewide limit, while providing businesses the greatest flexibility to reduce emissions at the lowest possible cost.

The Cap-and-Trade Program is a vital component in achieving both California's near-and long-term GHG emissions targets. California's Cap-and-Trade Regulation is purposely designed to leverage the power of the market in pursuit of an environmental goal. It opens the door for major investment in emission-reducing technologies and sends a clear economic signal that these investments will be rewarded. The Cap-and-Trade Regulation establishes a hard and declining cap on approximately 85 percent of total statewide GHG emissions. Under the Cap-and-Trade Regulation, ARB issues allowances equal to the total amount of allowable emissions over a given compliance period and distributes these to regulated entities. One allowance equals one metric tonne of greenhouse gases. Each regulated entity must hold allowances or other compliance instruments equal to its emissions.

The Cap-and-Trade Regulation gives companies the flexibility to trade allowances with others or take steps to cost-effectively reduce emissions at their own facilities. Companies that emit more have to turn in more allowances or other compliance instruments. Companies that can cut their GHG emissions have to turn in fewer allowances. But as the cap declines, aggregate emissions must be reduced. Companies can meet a limited portion of their compliance requirement by surrendering offset credits, which are rigorously verified emission reductions that occur from projects outside the scope of the Cap-and-Trade Regulation. The offset program was included in the Cap-and-Trade Regulation because it is an important cost-containment mechanism. The Cap-and-Trade Regulation currently recognizes offset protocols for four project areas: forestry, urban forestry, manure digesters, and the destruction of ozone-depleting substances. ARB recently adopted a compliance offset protocol for the capture and destruction of fugitive mine methane, and is developing a protocol to reduce GHG emissions from rice cultivation. ARB will continue to evaluate additional offset protocols with an emphasis on in-state opportunities.

With just the envisioned six compliance offset protocols, it is clear there will not be enough offsets to meet the 2013–2020 maximum offset demand if every entity chose to use the maximum number of allowable offsets. It should be noted that the Cap-and-Trade Program is designed so that offsets will play a larger role in cost containment in the later years of the program. As ARB continues to work to identify additional compliance offset protocols, there will be challenges, particularly for in-state offset protocols. California has a history of identifying and regulating emissions when it is feasible and cost-effective. Under AB 32, offsets must be additional to any regulatory requirement and beyond business-as-usual. California's focus on regulations limits opportunities for California offsets. This preference for regulatory solutions—which are mandatory under a regulation as opposed to voluntary under an offset protocol—ensures maximum emission reductions. However, it limits opportunities for offsets both in- and out-of State.

The Cap-and-Trade Regulation is being implemented in two stages. Electric generating utilities, electricity importers, and large industrial facilities became subject to the program beginning in 2013, and fuel distributors are brought under the cap in 2015.

The Cap-and-Trade Regulation is different from most of the other measures in the Scoping Plan. The regulation sets a hard cap, instead of an emission limit, so the emission reductions from the program vary as our estimates of "business as usual" emissions in the future are updated. In addition, the Cap-and-Trade Program works in concert with many of the direct regulatory measures—providing an additional economic incentive to reduce emissions. Actions taken to comply with direct regulations reduce an entity's compliance obligation under the Cap-and-Trade Regulation. So, for example, increased deployment of renewable electricity sources reduces a utility's compliance obligation under the Cap-and-Trade Regulation. Finally, the Cap-and-Trade

Regulation provides assurance that California's 2020 limit will be met because the regulation sets a firm limit on 85 percent of California's GHG emissions.

Under the Cap-and-Trade Regulation, a portion of the allowances required for compliance are auctioned by the State. The first auction of emission allowances occurred in November 2012. To date, ARB has held five successful auctions.

The State's portion of the proceeds from these auctions is to be used to fund projects to reduce GHG emissions. A three-year investment plan was submitted to the Legislature in May 2013, identifying the State's GHG emission reduction goals and priority programs for investment of the action proceeds. More discussion of auction proceeds and other investments is included in Chapter V.

Because the Cap-and-Trade Program applies only to California entities, ARB designed the regulation to minimize emissions leakage. ARB continues to conduct ongoing leakage assessment studies that are based on an evaluation of industry emissions and trade exposure.

ARB is considering several amendments to improve the Cap-and-Trade Regulation in 2014. In particular, ARB proposes to provide additional transition assistance in the form of free allowances to industrial producers while the new leakage studies are being conducted. In addition, ARB is proposing mechanisms to keep allowance prices within an acceptable range by allowing a limited number of future allowances to be used for compliance should prices get too high. The continuation of the Cap-and-Trade Program will enhance the effectiveness of the new cost containment mechanism proposal.

California linked its program with the Canadian Province of Québec in January 2014. California and Québec have worked together to harmonize their regulations and coordinate on a joint auction platform and tracking system. ARB provided a report on the status of linkage implementation to the governor and CalEPA in November 2013.

As part of the Cap-and-Trade Regulation, the Board also approved an Adaptive Management Plan[94] to track unintended consequences of the Cap-and-Trade Regulation. The Plan requires ARB to develop systems to track and respond to: (1) potential adverse localized air quality impacts that might be caused by the Cap-and-Trade Regulation, and (2) potential adverse impacts that might be caused by the Compliance Offset Protocol U.S. Forest Projects (Protocol). ARB is working with the local air districts to determine the most effective path forward for gathering and evaluating permit data, GHG data, and other information needed for tracking potential localized impacts. As part of this effort, ARB has amended the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions to collect information on GHG emission increases and decreases from covered entities. ARB has contracted with the University of California, Davis, and is working with forestry experts from around the country to develop an approach to understand potential forest impacts resulting from implementation of the Protocol under Cap-and-Trade.

Maintaining Momentum

The Cap-and-Trade Program will continue to be a vital component in achieving California's longer-term climate change goals. As the cap continues to decline, the Cap-and-Trade Program incentivizes emission reductions associated with the production of energy and goods and encourages consumers to reduce emissions. Sending the market a signal that the Cap-and-Trade Program will continue in the long-term is critical to fully realizing the benefits of the program. Continuing the program and establishing an emission cap beyond 2020 will also reduce the costs of the program as California industry and households make long-term capital and investment decisions. A clear path forward will lead to a lower-carbon California.

94 The 2011 Adaptive Management Plan for the Cap-and-Trade Regulation is available at *www.arb.ca.gov/cc/capandtrade/adaptive_management/plan.pdf*.

As the Cap-and-Trade Program continues to help achieve our long-term climate goals, it will be increasingly important to bolster the offset program. As noted above, there are real challenges to identifying in-state offset protocols, but ARB is committed to pursuing those that are workable. Part of the strategy to ensure sufficient offsets are available is to continue to consider international sector-based offset programs. The Cap-and-Trade Regulation already includes a placeholder for potential international sector-based offsets from programs designed to Reduce Emissions from Deforestation and Forest Degradation (REDD) through a future rulemaking. To that end, the REDD Offset Working Group, an ad hoc technical expert working group, labored for two years to develop technical and policy recommendations that were provided for consideration in final form to ARB, Acre (Brazil), and Chiapas (Mexico) in July 2013.[95]

Carbon capture and sequestration (CCS) is another option to reduce emissions under both the Cap-and-Trade Program and the Low Carbon Fuel Standard (LCFS). Successful development and deployment of CCS in California would provide in-State GHG emission reductions, lower an entity's compliance obligation under Cap-and-Trade, and potentially lower an entity's carbon intensity under LCFS.

B. Progress to Date

The initial Scoping Plan laid out an ambitious plan for reducing GHG emissions from a combination of direct regulatory measures, incentives, and market-based approaches. The Cap-and-Trade Program establishes an overall limit on GHG emissions from most of the California economy—the "capped sectors." Within the capped sectors, some of the reductionvvs are being accomplished through direct regulations, such as improved building and appliance efficiency standards, the LCFS, and the 33 percent RPS. Whatever additional reductions are needed to bring emissions within the cap is accomplished through price incentives posed by emissions allowance prices. Together, direct regulation and price incentives assure that emissions are brought down cost-effectively to the level of the overall cap. Reductions in the remainder of the economy—the "uncapped sector"—are being accomplished through specific measures, such as those for high-GWP gases and fugitive emissions from industrial sources.

Over the last five years, ARB has worked with other State and local agencies to implement the climate change programs outlined in the Scoping Plan and to ensure their smooth implementation. The State's progress on measures included in the Scoping Plan and other complementary activities have put California on the path to achieve the statewide GHG emissions limit of 1990 levels by 2020, and to achieve the maximum technologically feasible and cost-effective reductions over the long-term. Today, many of the State's GHG emission reduction measures and initiatives set forth in the initial Plan have been adopted and are in the early stages of implementation. Full implementation of all adopted measures by 2020 will not only allow us to reach our near term GHG goals but will also provide numerous additional public health and environmental benefits.

We measure progress toward the 2020 statewide limit in two ways:

- **Evaluating the expected emission reductions from ongoing regulations and programs:** ARB and other State agencies are implementing numerous programs to reduce GHG emissions. The California Greenhouse Gas Report Card is an annual report that summarizes state agency activity to reduce greenhouse gases.[96] To assess whether California will meet the 2020 limit, it is necessary to estimate the expected emission reductions from these measures in 2020 based on the regulatory requirements.

95 REDD Offset Working Group. 2013. California, Acre and Chiapas – Partnering to Reduce Emissions from Tropical Deforestation: Recommendations to Conserve Tropical Rainforests, Protect Local Communities and Reduce State-Wide Greenhouse Gas Emissions. Available at *http://greentechleadership.org/documents/2013/07/row-final-recommendations-2.pdf*.

96 The State Agency Greenhouse Gas Reduction Report Card is available at : *www.climatechange.ca.gov/climate_action_team/reports/2013_CalEPA_Report_Card.pdf*.

- **Evaluating emission trends:** Each year, ARB updates the statewide GHG emission inventory. This information provides a retrospective look at emissions and is based on actual data, either reported directly to ARB or to other regulatory agencies. The emission inventory is useful for evaluating progress in sectors that are affected by many different programs. For example, the electricity sector is affected by the Renewable Energy Standard, energy efficiency programs implemented by utilities, appliance efficiency standards, building codes, and numerous other programs. One way to assess progress in this sector is to retrospectively examine whether actual emission trends are consistent with our expectations.

ARB used both of these methods to evaluate progress toward the 2020 statewide limit in this Update. As the Scoping Plan is in the early stages of implementation, this evaluation will be ongoing.

1. Key Accomplishments

California has undertaken a number of notable groundbreaking climate change initiatives. These include the first in the nation economy-wide Cap-and-Trade Program, the Low Carbon Fuel Standard, a 33 percent Renewable Portfolio Standard, and an Advanced Clean Cars program that has been adopted at the federal level. ARB has also worked closely with our local and regional partners to implement the Sustainable Communities and Climate Protection Act of 2008 (Senate Bill 375). Strategies developed under this program integrate land use, housing, and transportation planning to reduce regional passenger vehicle GHG emissions.

In addition to these efforts, additional actions include Building and Appliance Energy Efficiency Standards, the California Solar Initiative (i.e., Solar Hot Water Heaters and Million Solar Roofs), Water Efficiency, Mandatory Commercial Recycling, and High-Speed Rail.

2. GHG Emissions Trends

In 2006, Assembly Bill 1803 mandated that ARB prepare, maintain, and update California's statewide GHG emission inventory. The GHG emission inventory serves as the foundation for tracking the State's emission trends and progress toward California's GHG emission reduction goals. The GHG inventory provides estimates of the amount of GHGs emitted to the atmosphere by human activities within California. The inventory includes estimates for carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), which are often referred to as the "six Kyoto gases," plus nitrogen trifluoride (NF_3). The emission estimates of the seven gases are typically expressed in terms of million tonnes of carbon dioxide equivalents ($MMTCO_2e$). The emissions of the non-carbon dioxide gases are converted in CO_2e units based on their global warming potential relative to that of carbon dioxide.

The California statewide GHG emission inventory is structured and aligned with the Guidelines for National Greenhouse Gas Inventories developed by the IPCC (2006). Emission estimates rely primarily on state, regional, or national data sources. The inventory also incorporates methodology and data from the Inventory of U.S. Greenhouse Gas Emissions and Sinks, published by the U.S. EPA.[97] Starting in 2008, facility-level data from ARB's Mandatory GHG Reporting Program have been used to compile statewide emissions from electricity generation facilities, refineries, cement plants, and lime and nitric acid production facilities.

ARB regularly publishes updated versions of California statewide GHG emission inventory on its Greenhouse Gas Emission Inventory website.[98] A technical support document detailing the data sources and methods used to develop the inventory is also available for download from the same website. The current inventory compiles statewide anthropogenic GHG emissions from 2000 through 2012, using consistent sets of data and methods to allow for the detection of trends over time (Figures 8a and 8b). ARB updated the GHG emission inventory in this Update to be based on GWPs in the IPCC's Fourth Assessment Report.

97 *www.epa.gov/climatechange/ghgemissions/usinventoryreport.html*)
98 *www.arb.ca.gov/cc/inventory/inventory.htm*.

Figure 8a: California Total and Per Capita GHG Emissions (2000-2012)

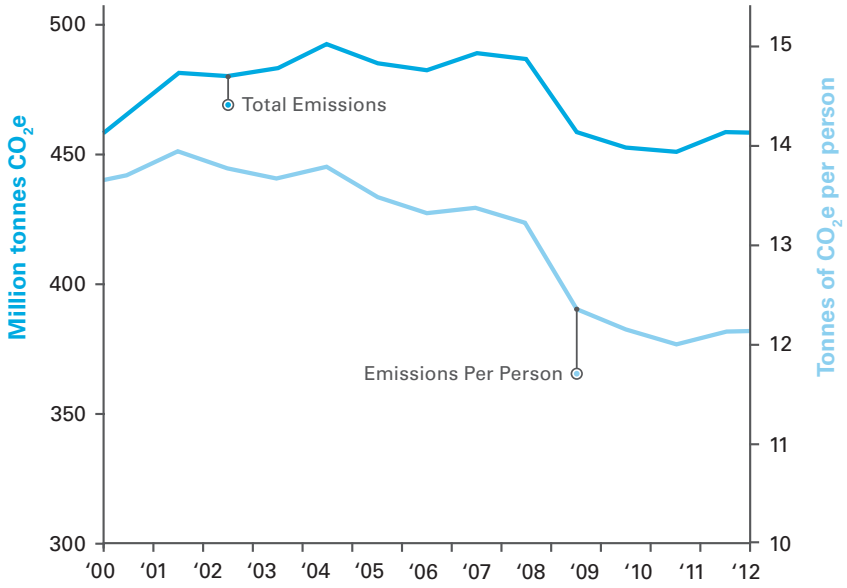
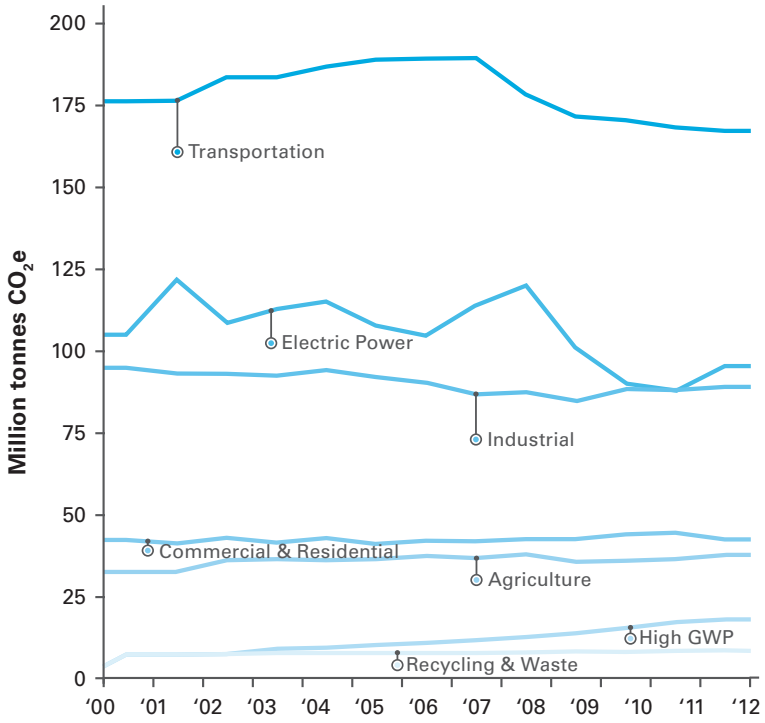


Figure 8b: California Sectoral GHG Emissions (2000-2012)



Over the last decade, the total statewide GHG emissions decreased from 466 $MMTCO_2e$ in 2000 to 459 $MMTCO_2e$ in 2012—a decrease of 1.7 percent. The emissions in 2012 increased for the first time in the five-year period since 2007. This increase was driven largely by the increased natural gas-generation of in-state electricity due to the closure of the San Onofre Nuclear Generating Station (SONGS) as well as dry hydrological conditions in 2012 (drought) causing a drop in the in-state hydropower generation. California's population grew by 11.3 percent between 2000 and 2012. As a result, California's per capita GHG emissions have decreased by 11.6 percent. The recent recession had a major impact on GHG emissions between 2008 and 2009, when emissions

decreased by almost six percent. Other changes reflect ongoing early implementation of Scoping Plan measures, energy efficiency actions, renewable power requirements, and hydrology (rain and snow fall). In 2012, emissions from the transportation sector continued to decrease while emissions from the electric power sector increased from the previous year. Emissions from all other sectors remained relatively constant since 2000.

A summary of the trends in emissions observed for each of the major sectors of the statewide GHG inventory is provided below.

Transportation Sector: The transportation sector remained the largest source of GHG emissions in 2012, constituting more than 36 percent of California's GHG emission inventory. Emissions decreased by five percent between 2000 and 2012. Emissions from on-road vehicles constituted over 92 percent of the transportation sector. These emissions have declined each year since 2007, with the greatest decrease occurring at the time of the recession. In the summer of 2008, fuel prices reached a historic maximum, followed by a dramatic decrease in the consumption of gasoline and diesel fuel. Total transportation fuel consumption declined in 2008, and even with modest increases in 2009 and 2010, on-road emissions continued to decrease, remaining below pre-recession levels as the economy improved.

Electric Power: Greenhouse gas emissions from electricity generation have decreased by 9 percent from 2000 to 2012, in spite of the shutdown of the San Onofre Nuclear Generating Station (SONGS) and low hydro-power generation due to the drought, both of which caused an increase in emissions for 2012. California produces almost 70 percent of its electricity within the State and imports the rest. Emissions from in-state electricity generation decreased by more than 13 percent between 2000 and 2012. During that period, electricity consumption grew from 265.8 terawatt-hours (TWh) in 2000 to 282.1 TWh in 2012, with a peak of 288.0 TWh in 2008.

Over the last twelve years, on average, hydropower provided 13 percent of California's electric power generation. The amount of hydropower produced is dependent on rainfall and was highest in the two wettest years, 2006 and 2011. Hydropower production, as well as other non-emitting sources of energy, affects the GHG intensity of electricity generation (the amount of CO_2e emitted per megawatt-hour [MWh] generated). The GHG intensity of California electricity peaked in 2001 and reached a low point in 2011, a particularly wet year. Both the GHG intensity of in-state generation and that of electricity imports have been reduced since 2008, with in-state intensity showing a slight increase in 2012 due to the double impacts of the SONGS shutdown and the low hydro-power output caused by the drought.

Industrial Sector: Industrial emission sources include refineries, oil and gas extraction, cement plants, and other stationary sources that consume fuel. Emissions from the industrial sector have declined overall, decreasing by six percent between 2000 and 2012. Associated with the recession, a decline of three percent was observed in 2009. However, emissions grew by four percent from 2009 to 2010. Emissions from cement plants, made up of fuel combustion and clinker process emissions, peaked in 2005, with a decrease beginning in 2006 and continuing through 2010. Between 2005 and 2010, cement plant emissions declined 44 percent, reflecting a large decrease in demand due to the crisis in housing and construction, as well as the closure of three cement plants in the State over the period. Cement production has begun to recover, showing a 24 percent increase in emissions in 2012 from its 2010 low.

Commercial and Residential Sectors: Emissions from the commercial and residential sectors are driven by the combustion of natural gas and other fuels for household use and heating and for providing energy for commercial businesses. Emissions remain flat over the past twelve years between 2000 and 2012.

Emissions from residential fuel combustion showed a decline of five percent over the last twelve years, with its lowest point of 28.1 million tonnes occurring in 2012. At the same time, the number of housing units grew steadily, from 12.2 million units in 2000 to slightly over

13.7 million in 2012, resulting in a sharp decline in the fuel consumption per housing unit. The commercial sector emissions increased 16 percent between 2000 and 2012, but at the same time commercial use of floor space has increased slightly faster, resulting in slightly reduced emissions per unit of floor space.

Agricultural Sector: Agricultural emissions represent the sum of emissions from agricultural machinery fuel use, residue burning, soil management and fertilization, enteric fermentation, manure management, and rice cultivation. Emissions (primarily methane emissions from livestock) increased by 16 percent between 2000 and 2012. Agricultural fuel use was the only category that saw a GHG emissions decrease from 2000 to 2012, decreasing by three percent over that period. On the other hand, emissions from manure management increased 29 percent during the same period, reflecting the growth of the number of animals in agriculture in California.

High-GWP Gases: High Global Warming Potential (high-GWP) gases included in the inventory consist primarily of substitutes for ozone-depleting substances. Emissions from this sector increased by 129 percent between 2000 and 2012. This growth is driven by the increasing substitution of these gases to replace ODS gases in refrigeration, air conditioning, aerosols, and other applications over the last decade.

Recycling and Waste: Emissions from the recycling and waste sector consist of methane and nitrous oxide emissions from landfills and from commercial-scale composting, which increased by 16 percent between 2000 and 2012.[99] Emissions from landfills constitute about 94 percent of the total emissions of this sector. In 2000, 37 million tons of solid waste was deposited in California's landfills; deposits grew to 42 million tons by 2005, followed by a steady decline to 29 million in 2012. The decrease in annual landfill deposits has not yet resulted in a landfill emissions trend decline however, since the total waste-in-place not yet decomposed that has accumulated from the landfills' opening continues to drive the increasing amount of landfill gas generated.

3. Emission Reductions to Meet the 2020 Statewide Limit

Assembly Bill 32 required ARB to determine California's 1990 statewide GHG emissions level, which would become California's near-term statewide emissions limit to be achieved by 2020. ARB developed a California statewide GHG emission inventory for years 1990–2004 to support the effort of determining the 1990 level and 2020 emissions limit. In December 2007, the Board approved a total statewide GHG 1990 emissions level and 2020 emissions limit of 427 $MMTCO_2e$, based on the IPCC's Second Assessment Report. As discussed in Chapter II, most national and international climate change organizations are moving to the IPCC's Fourth Assessment Report, which updated the global warming potential of GHGs, especially methane and HFCs. ARB is proposing to update the number for the 2020 limit, weighting the 1990 emissions with 100-year GWPs from the IPCC's Fourth Assessment Report. The new 2020 statewide limit is 431 $MMTCO_2e$—an approximately one percent increase from the 427 $MMTCO_2e$ limit adopted by the Board in 2007. In addition, to assess progress toward the limit in a consistent manner, ARB is using GWPs from the Fourth Assessment Report to update projections of the emission reductions that adopted and anticipated Scoping Plan measures will achieve.

ARB maintains the statewide GHG emission inventory to track California's progress toward the 2020 statewide emissions limit. To determine the amount of GHG emission reductions needed to reduce to 1990 emissions, ARB developed a forecast of 2020 emissions in a business-as-usual scenario (2020 BAU),[100] which is an estimate of the emissions expected to occur in the year 2020 if none of the foreseeable measures included in the Scoping Plan[101] were implemented. ARB

99 See the Recycling and Waste sector discussion earlier in this chapter for a discussion of additional GHG emission reductions associated with upstream activities.

100 *www.arb.ca.gov/cc/inventory/data/forecast.htm*.

101 *www.arb.ca.gov/cc/inventory/data/tables/reductions_from_scoping_plan_measures_2010-10-28.pdf*.

subtracts the estimated reductions from adopted and anticipated measures in 2020 to determine whether the 2020 limit is within reach (Table 5). The Cap-and-Trade Regulation provides a firm cap, ensuring that the 2020 statewide emission limit will not be exceeded. Thus, the estimated emission reductions attributed to the Cap-and-Trade Program depend on the emissions forecast. For example, if the emissions forecast increases, the reductions associated with the Cap-and-Trade Program will increase.

Table 5: Meeting the 2020 Emissions Target

Category	2020 ($MMTCO_2e$)**
AB 32 Baseline 2020 Forecast Emissions (2020 BAU)	509
Expected Reductions from Sector-Based Measures	
Energy	25
Transportation	23
High-GWP	5
Waste	2
Cap-and-Trade Reductions	23*
2020 Limit	431

* Cap-and-Trade emission reductions depend on the emission forecast.
** Based on AR4 GWP values.

C. Next Steps

Since the initial Scoping Plan was released, California has put in place a number of measures that have already led to significant emission reductions, and a transformation to a strong, stable low-carbon economy in California is under way. It is critical that California continues to develop and implement a successful climate policy. Planning must begin now to transition the State toward meeting our longer-term GHG emission reduction goals. Table 6 summarizes the recommended actions the State should take in each of the sectors discussed earlier in this chapter to meet our climate change goals.

Table 6: Summary of Recommended Actions by Sector

All Sectors		
Set mid-term targets to meet a State mid-term GHG emission reduction goal when defined.		
Energy Actions	**Lead Agency**	**Expected Completion Date**
Develop a comprehensive and enforceable GHG emission reduction program for the State's electric and energy utilities.	ARB CEC CPUC CAISO	2016
Develop criteria and rules for flexible demand response resources to participate in wholesale markets and integrate variable renewable resources.	CPUC CAISO	TBD
Expand participation of regional balancing authorities in CAISO Energy Imbalance Market and other methods of balancing authority cooperation.	CAISO	Ongoing
Through AB 758 process, develop a plan to encourage energy assessments and energy use disclosure requirements.	CEC	2016
Enhance energy efficiency and demand-response programs, and develop robust methodologies to monitor and evaluate the effectiveness of these programs.	CEC CPUC CAISO	Methodologies by 2015/ Enhanced program proceedings by 2016
Develop ministerial, low-cost interconnection process for distributed generation.	CPUC CEC CAISO	2015
Assess existing barriers to expanding the installation of CHP systems and propose solutions that help achieve climate goals. A future CHP measure could establish requirements for new or upgraded efficient CHP systems.	ARB CEC CPUC CAISO	2016
Continue development of statewide programs that could require new residential and commercial construction to meet ZNE standards.	ARB CPUC CEC	TBD
Develop cost-effective, on-site reductions for large industrial facilities, consistent with the audit findings under the Energy Efficiency and Co-Benefits Audits for Large Industrial Sources Measure.	ARB	TBD
Develop measures to control fugitive methane and carbon dioxide emissions from oil and gas production, processing, and storage tanks.	ARB	2014
Develop measures to reduce fugitive emissions from natural gas transmission and distribution pipelines and associated facilities (e.g., compressor stations).	ARB CPUC	TBD in the SLCP Plan
Work with the local air districts to evaluate amendments to their existing leak detection and repair rules for industrial facilities to include methane leaks.	ARB	Ongoing
Evaluate the potential for CCS in California to reduce emissions of CO_2 from energy and industrial sources. Working with Division of Oil, Gas and Geothermal Resources, CEC and CPUC, ARB will consider a CCS quantification methodology for use in California	ARB	2017

Transportation Actions	Lead Agency	Expected Completion Date
Propose "Phase 2" heavy-duty truck GHG standard standards.	ARB	2016
Expand upon 2013 ZEV Action plan for medium- and heavy-duty ZEVs.	OPR	2017
Enhance and strengthen the LCFS with more aggressive long-term targets.	ARB	2014
Adopt the necessary regulations and/or policies to further support commercial markets for low-carbon transportation fuels.	ARB CPUC CEC CDFA	2018
Evaluate updating the SB 375 regional targets established in 2010.	ARB	2014
Ensure GHG emission reductions from approved SCS are achieved or exceeded through coordinated planning.	ARB Caltrans SGC HCD Local & Regional	Ongoing
Construct HSR system • Complete all station-area planning. • Complete Caltrain component of HSR. • Complete initial operating segment of HSR. • Run HSR from San Francisco to Los Angeles.	High-Speed Rail Authority	2017 2019 2022 2029
Complete the first phase of the Sustainable Freight Strategy, which will identify and prioritize actions through 2020 to move California towards a sustainable freight system.	ARB	2014
Provide expanded markets for clean passenger transportation, advanced technology trucks and equipment, low-carbon transportation fuels and energy, and related infrastructure.	ARB CEC CPUC CDFA	TBD
Consider lifecycle benefits and impacts for transportation infrastructure projects	Caltrans	TBD
Increase Caltrans and regional transportation agencies' investments in expanded transit and rail services, active transportation, and other VMT reduction strategies in regional transportation plans.	Caltrans & Regional Transportation Agencies	TBD
Support Sustainable Communities Strategies to provide more efficient consumer choices.	SGC	Ongoing
Incorporate into ongoing GHG planning efforts strategies that help achieve significant NO_x reductions by 2032 to meet the national ambient air quality standards for ozone. The 2016 SIPs will outline attainment strategies through 2032.	ARB Caltrans	2016

Agriculture Actions	Lead Agency	Expected Completion Date
Convene an interagency workgroup whose purpose is to: (1) establish agriculture-sector GHG reduction planning targets for the mid-term time frame and 2050; (2) develop a California-specific agricultural GHG tool to estimate GHG emissions and sequestration potential from all on-farm sources; (3) strategies to reduce GHG emissions associated with energy in agricultural water use.	CDFA ARB CEC CPUC	2014
Develop a methane capture standard.	Dairy Digester Workgroup	2016
Evaluate data reported to Long Term Irrigated Lands Programs, to determine if the reported fertilizer data are adequate to establish a robust statewide GHG N_2O inventory for fertilizer used in agriculture.	RWQCB	2017
Develop recommendations for a coordinated local land use program.	OPR CNRA CalEPA CDFA ARB	2015
Implement actions in Bioenergy Action Plan to promote the input of digester biogas into natural gas pipelines and bioenergy onto the electric grid, evaluate the potential biomass energy generation capacity, and develop methods to quantify biomass life-cycle GHG flux.	Bioenergy Interagency Working Group	Ongoing
Water Actions	**Lead Agency**	**Expected Completion Date**
Give priority to funding integrated management plans that include robust existing or proposed water and energy conservation and efficiency, and measures that achieve GHG emission reductions. Conservation programs must include numeric targets.	DWR SWRCB	2014
Implement new water-related energy conservation measures and efficiency standards	CEC	2015
Complete water-energy nexus rulemaking and continue implementation of joint water-energy utility efficiency programs and partnerships.	CPUC	2016
Incent resource-recovering wastewater treatment projects.	SWRCB CPUC	2015
Implement green infrastructure permits to treat and capture urban runoff for local use.	SWRCB RWQCB	2016
Guide adoption of GHG emission-reducing policies for water sector investments and action. Conservation measures and regulations to reduce GHG emissions and maintain water supply reliability during drought periods will be a centerpiece of this administration action.	DWR SWRCB CPUC CDFA ARB	2015
Identify and incent implementation of rate structures that accurately reflect the economic, social, and environmental value of water in California while maintaining affordability for basic services.	DWR SWRCB CPUC CDFA	TBD
Develop a comprehensive groundwater management strategy and provide technical and financial assistance to exceed SBx7-7 targets.	SWRCB DWR CDFA	TBD
Modify State and regional water board policies and permits to achieve conservation, water recycling, stormwater reuse, and wastewater-to-energy goals.	SWRCB RWQCB	2016
Promote water-energy conservation outreach and education.	DWR SWRCB CPUC CEC CAISO	TBD

Waste Management Actions	Lead Agency	Expected Completion Date
Eliminate the disposal of organic materials at landfills.	CalRecycle ARB	2016
Implement financing or incentive mechanisms for in-State infrastructure development to support Waste Sector goals.	CalRecycle ARB	TBD
Develop actions to address cross-California agency and federal permitting and siting challenges associated with composting and anaerobic digestion.	ARB	2014
Identify opportunities for additional methane control at new and existing landfills, and use of captured methane as a fuel source for stationary and mobile applications.	ARB	TBD in the SLCP Plan
Develop new emission reduction factors to estimate GHG emission reduction potential for various recycling and remanufacturing strategies.	ARB CalRecycle	TBD
Identify improvements to the procurement of recycled-content materials through the State Agency Buy Recycled Campaign reform.	CalRecycle DGS	2014
Natural and Working Lands Actions	**Lead Agency**	**Expected Completion Date**
Convene an inter-agency forest climate workgroup to prepare and publish a "Forest Carbon Plan."	CNRA CalEPA	2016
Evaluate methods to develop a life cycle analysis to track carbon in wood products.	CAL FIRE BOF	2016
Implement actions in Bioenergy Action Plans related to use of forest biomass, evaluate the potential biomass energy generation capacity, and develop methods to quantify biomass life-cycle GHG flux.	Bioenergy Interagency Working Group	Ongoing
Develop recommendations for a coordinated local land use program.	OPR CNRA CalEPA CDFA CDFW CAL FIRE ARB	2015
Convene an interagency workgroup to draft a report outlining funding needs, opportunities, and priorities for Natural and Working Lands.	CNRA CalEPA CDFA CDFW CAL FIRE ARB	2015
Expand urban forestry and green infrastructure programs and investments, particularly in California's environmental justice communities.	CAL FIRE	Ongoing

Short-Lived Climate Pollutants Actions	Lead Agency	Expected Completion Date
Develop a comprehensive strategy for mitigation of short-lived climate pollutants, including methane.	ARB	2015
Continue diesel controls that will reduce black carbon emissions by 95 percent from the late 1960s to 2020.	ARB	2020
Reduce emissions of smog-forming pollutants by about 90 percent below 2010 levels by 2032 to meet the National Ambient Air Quality Standard for ozone.	ARB	2032
Create an agreement with U.S. EPA to establish national standards for the proposed F-gas phasedown of HFC production.	ARB	2030
Require low-GWP gases where feasible and cost-effective.	ARB	TBD in the SLCP Plan
Incentivize recovery and destruction of ODS at end of life by a combination of strategies.	ARB	TBD in the SLCP Plan
Set an upstream mitigation fee on sales of high-GWP gases and sales or import of equipment pre-charged with high-GWP gases.	ARB	TBD in the SLCP Plan
Green Building Actions	**Lead Agency**	**Expected Completion Date**
Build on California's existing zero net energy building goals and activities.	CEC CPUC	2015
Continue research activities to better quantify GHG emission reduction potential of certified green buildings.	ARB	2016
Strengthen the next two triennial editions of the Green Building Standards Code with mandatory provisions that reduce GHG emissions.	CBSC	2016 & 2019
Building on AB 758 Action Plan implementation activities, explore opportunities to implement a portfolio of green building retrofit requirements at time-of-sale or other trigger mechanism.	CEC	2017
Explore methodologies to quantify direct and indirect GHG emissions from new and existing buildings.	TBD	2017
Establish target dates and pathways toward transitioning to zero net carbon buildings that expand upon and complement ZNE goals.	ARB CPUC CEC	2017
Implement a mechanism to track progress toward achieving statewide green building goals.	ARB CPUC CEC	2018
Cap-and-Trade Actions	**Lead Agency**	**Expected Completion Date**
Develop a plan for a post-2020 Cap-and-Trade Program, including cost containment, to provide market certainty and address a mid-term emissions target.	ARB	2017

Evaluation Actions	Lead Agency	Expected Completion Date
Develop a plan for an Ex Post Assessment of Realized Cost and Benefits of AB 32.	ARB	2014
Assess the effects of AB 32 programs on disadvantaged communities	ARB	2014 (Phase I)
Develop guidance for agencies administering Cap-and-Trade auction proceeds, including actions to fulfill the requirements for investments to benefit disadvantaged communities.	ARB	2015
Report annually to the Legislature on auction proceeds investment results and benefits to disadvantaged communities.	ARB DOF	Ongoing
Update the three-year Cap-and-Trade Auction Proceeds Investment Plan, identifying funding gaps and new investments needed for GHG emission reductions and other environmental and public health benefits.	ARB	2016

V. Achieving Success

Climate change presents an unprecedented set of challenges for California that cuts across sectors and policy areas. These emerging challenges are increasingly unifying policy planning across government agencies and jurisdictions, allowing us to do more with less – achieving multiple goals more quickly and effectively than if we address separate priorities in isolation.

Successfully delivering on California's climate policies and realizing the full benefits of California's leading approach to climate change requires careful policy planning and implementation, diligent monitoring, and evaluation of policies (Chapter VI). We are integrating climate thinking and sustainability programming into the range of actions we take to grow the economy, protect the environment, and plan for the future. Increasingly, we must coordinate planning to ensure that the way we design and grow our communities for the future allows us to meet all of our goals – including those related to economic growth, equity, climate change and resiliency, air quality, water quality and reliability, mobility, public health, and others. Of course, achieving success requires targeted investment and market support, to launch commercial markets for the cleanest technologies and build the infrastructure we need to support continued economic growth in California that is increasingly free of pollution and consequence for disadvantaged communities or future generations. And it requires active outreach to share our successful approach and expand global action to address climate change.

With strategic investment and coordinated policy-making, California can slash emissions from trucks and trains while at the same time building a world-class goods movement and freight-delivery system. We can modernize our rail and passenger transportation systems to move people in ways that both reduce greenhouse gases and increase mobility options and safety. We can take actions to cut emissions of potent short-lived climate pollutants that will also deliver key public health benefits. And we can align strategies that both support reduction goals and bolster our ability to deal with the impacts of climate change already underway.

The imperative of climate change can push action to advance priorities that affect every aspect of our built and natural environments, and quality of life. Effectively implementing California's climate plan will not just chart the path in the fight against climate change, but also to cleaner air, better health, and lasting, equitable growth.

A. Integrate and Coordinate Planning

California faces many critical, and equally important, planning objectives. In order to most effectively meet each of them, minimize costs, and maximize and accelerate benefits, the State is focused on integrating planning objectives and ensuring that limited investments advanced as many objectives as possible. The strategies we pursue to cut greenhouse gas emissions from our cars, trucks, buses, trains and industries can support ongoing efforts to improve air quality up and down the state, especially in our most heavily impacted communities. Efficiency and conservation programs in the water sector needed to cut emissions will also drive critically

needed efforts to enhance supply and reliability priorities. We can cut emissions from our waste stream while also increasing home-grown sources of low-carbon energy and fuels. And we can manage our natural lands and valuable agricultural resources in ways that both achieve climate goals and enhance their long-term sustainability.

The nexus between air quality and climate is a key example. The South Coast and San Joaquin Valley Air Quality Management Districts, together home to more than half of the State's population, must reduce emissions of smog-forming pollutants by about 90 percent below 2010 levels by 2032 to meet the National Ambient Air Quality Standards. Many of the technologies and strategies to reduce smog-forming pollution or GHG emissions are the same. Advancing progress on climate change should advance progress on air quality, and vice versa. By effectively integrating our planning to do so, as California has done through its Vision modeling exercise and Sustainable Freight Plan (among other activities), we can accelerate progress to meet both air quality and climate change objectives.

Amid dire drought, the availability, reliability, and quality of water are taking center stage. Water efficiency, conservation, and storage are connected to energy efficiency and supply, food supply, land use and housing, and economic growth of our agricultural and other sectors. The phase-out of once-through cooling in the State's power plants links energy supply with water availability, quality, and habitat. As we respond to the drought, develop an increasingly clean and reliable energy supply system, and build upon California's climate framework, we must ensure that our efforts in one area recognize and reinforce the objectives in the others. To that end, DWR has developed a Climate Action Plan. The State Water Board is developing a Guidance Document on Climate Change. Together with other efforts being led through the Climate Action Team and those identified in this Update, California is increasingly focused on integrating objectives for climate and water policy planning.

Increasingly, technologies and planning objectives are converging across sectors. Electrification in the transportation and building sectors must coincide with decarbonization of electricity supply. New electricity loads from these sectors, as well as increasing levels of renewable generation, will change the operational requirements of the electricity grid, which in turn affects emissions and operations for electric transportation. Changes in the energy sector will affect the water and agricultural sectors due to the significant amount of energy used to move water throughout the State and the important role and evolving role of hydropower in the electricity system. Green and net zero energy buildings create new accounting requirements and interactions between utilities and customers and buildings and the electricity grid. The growing role of bioenergy for transportation fuels, heat production, and electricity generation will impact the agricultural, natural lands, water, and waste management sectors. All of this will have direct or indirect effects on land use that will require integrated planning and a closely coordinated effort with locally driven GHG emission reduction initiatives. State agencies are addressing each of these cross-cutting issues and others through standing, interagency working groups that all keep climate change as an overarching or integral theme.

Integrating planning to achieve multiple objectives inherently requires coordination among planning agencies across sectors, systems, and governmental jurisdictions. Already, climate change is serving as a unifying objective that is bringing unprecedented levels of collaboration among government agencies. California state agencies meet routinely and work very collaboratively as part of the Climate Action Team or other climate-related working groups. ARB is working with Caltrans, the South Coast Air Quality Management District, and many other agencies and stakeholders to develop the Sustainable Freight Strategy. SB 375 has created new relationships and coordinated planning between state and local planning agencies. The Desert Renewable Energy Conservation Plan is a unique collaboration among state and federal agencies. And this Scoping Plan Update is key example of the level of coordination happening among California State agencies to address climate change.

State Plans that Will Assist the State in Meeting Its GHG Goals

- California Climate Adaptation Strategy
- Safeguarding California Plan (Update to 2009 Adaptation Strategy)
- California's Clean Energy Future
- ARB's Vision for Clean Air
- California Agricultural Vision
- DWR Climate Action Plan
- CEC Integrated Energy Policy Report
- California Transportation Plan
- Strategic Fire Plan for California
- Water Action Plan
- Environmental Goals and Policies Report
- Zero Emission Vehicle (ZEV) Action Plan
- Caltrans Interregional Blueprint
- Climate Research Plan
- Vision California
- State Implementation Plan
- CDFW Vision for Confronting Climate Change in California
- Extreme Heat Adaptation Guidance Document
- AB 341 75% Plan (in development)

California's state agencies are collaborating to achieve the State's climate change goals and broader environmental protection goals, in concert with achieving their own individual agency's goals. It will be necessary to maintain and strengthen this collaborative effort, and to draw upon the assistance of regional and local governments and private institutions, to achieve the State's near-term and longer-term emission reduction goals and improve its ability to adapt to potential climate change impacts.

The Governor's Office provides leadership to set priorities and to ensure a coordinated effort is taken among the numerous State agencies and departments in pursuing GHG emission reductions. To this end, Governor Brown has overseen the development of the Zero Emission Vehicle Plan and Bioenergy Action Plan, and has set distributed generation and combined heat and power goals for the State in his California Clean Jobs plan. The Governor's Office of Planning and Research (OPR) has hosted several stakeholder conferences and participated in research efforts on issues including climate change adaptation risks and strategies, zero emission vehicles and infrastructure planning, strategies to increase renewable and distributed energy integration, GHG emission assessments in CEQA, and streamlining criteria. OPR is also providing outreach and technical assistance to regional and local government transportation and land use planning agencies.

Climate change, like many issues, crosses economic sectors, policy areas, and governmental jurisdictions. Recognizing this, the State has established interagency workgroups to provide coordinated policies and strategies in various key areas where GHG emission reductions are needed to meet California's 2020 limit. For example, the Water-Energy Team of the Climate Action Team (WET-CAT), consisting of over two dozen State agency and academia representatives, is tasked with coordinating efforts on both GHG emission reductions and adaptation actions affecting the portion of the energy sector that supports the storage, transport, and delivery of water in California while ensuring that the State continues to maintain water quality and adequate water supplies. Part of the WET-CAT effort has been to provide recommendations to pertinent agencies on water and energy policies and actions.

This Update is California's plan for future actions to reduce climate-changing emissions. Other State agencies have already developed plans and actions specific to their priorities that will assist California in fulfilling the vision set forth in the Scoping Plan and this Update, and are expected to continue to do so. Some plans are interagency plans, developed in coordination with

numerous State agencies' policies and priorities. Future State agency planning tools must incorporate mechanisms to help the state meet California's GHG emission reduction goals.

Action plans have been developed in concert with adaptation planning and climate research. State environmental goals and objectives should be integrated and framed to align State agency decision-making toward attaining these goals, as proposed in the Governor's Environmental Goals and Policies Report.

B. Transportation, Land Use, and Housing Planning Development

One of the most critical, cross-cutting issues for addressing climate change and other integrated policy priorities is land use and development.

Over the past 60 years, growth in automobile ownership, development of the highway system, and the rise of suburban neighborhoods has dominated the landscape in much of California and the United States. This development pattern has created a dispersed network of cities and towns, which can be difficult to serve efficiently with transportation and other necessary public services. In the same way that past policies have shaped today's built environment, actions taken today will establish the foundation for a more sustainable future.

For the first time, State law (SB 375) requires an integrated approach to planning our transportation system and land use. Metropolitan planning organizations and local governments are collaborating to evaluate alternative future scenarios that could make land use development patterns and supportive transportation systems more sustainable. Regional planning agencies that are responsible for forecasting growth and preparing transportation plans to accommodate that growth are already responding to significant demographic and market shifts that call for changes in the way we plan our housing and transportation

SUCCESS STORY

Local Governments in Action

In 2013, the City of Palo Alto switched to 100 percent renewable energy. To support this, the city authorized solar power purchases totaling 182,500 MWh of solar a year—enough to power the city's 65,000 residents and more.

The City of Tulare in central San Joaquin Valley has implemented extensive building retrofit and residential solar programs, created a 100 percent green-powered wastewater treatment facility by installing a 900 kilowatt (kW) fuel cell system, one MW of solar power, and much more. Through these improvements, Tulare is expected to save more than $13.9 million in energy costs and avoided capital and operation costs.

In 2010, the Metropolitan Transportation Commission awarded $33 million in grants to promote: innovative, breakthrough techniques to reduce GHG emissions; purchase electric vehicles for public agencies and tribes, and to electrify City CarShare; bringing shore power to the Port of Oakland; implementation of bike-detecting traffic signals; and more.

In December 2012, the City of Glendale launched the use of "smart meters" for all 120,000 residents, which will result in considerable electricity savings over the next 15 years through energy efficiency, increased options for time-of-use electricity rates, and real-time user consumption data to encourage conservation.

Sonoma County's Energy Independence Program (SCEIP) is an innovative voluntary financing program that uses the property tax system to fund permanent energy efficiency, water-efficiency, and renewable-energy improvements. Since 2009, SCEIP provided $64 million in funding to more than 1,900 property owners in the county.

infrastructure. Recently adopted regional sustainable community strategies (SCS) are designed to respond to shifts in the way future generations of Californians will live, work, recreate, and travel. As residential development constitutes the largest share of urbanized and land uses, changes in housing development are particularly critical to influencing travel patterns, energy use, and emissions. Location-efficient, affordable transit-oriented development (TOD), for example, has been estimated to yield VMT reductions of 20 to 40 percent over households in non-TOD locations. In large urban regions of California, the demand for more livable cities with smaller dwelling units located close to activity centers and more transportation options are creating momentum for more sustainable community development. As transit ridership is highest among lower-income households, many of whom already reside in transit-rich areas, the preservation and upgrading of affordable housing in these locations is also important.

Traffic congestion and higher gasoline prices are forcing consumers to consider the financial ramifications of longer commutes and continued use of fossil-fueled vehicles. Recent demographic trends predict a shift toward lower vehicles miles traveled both in-state and nationally, along with changing attitudes toward driving automobiles. For example, nationally, young people between 16 and 34 drove 23 percent fewer miles on average in 2009 than they did in 2001.[102] Those born between 1983 and 2000 are more likely to want to live in urban and walkable neighborhoods and are more open to public transportation than older Americans. These trends are expected to continue beyond 2020.

Metropolitan areas are beginning to change and trend toward more dense urban development designed to minimize energy consumption, waste output, air pollution, and water pollution. Business districts are encouraging more infill development that offers a mix of residential space, entertainment, restaurants, shopping, and other amenities within close proximity, which reduces dependence on private vehicles. These trends create opportunities for developers to satisfy changing consumer desires and for land- use planners to establish policies for more sustainable development patterns. It takes decades for changes in land use and transportation policies to result in tangible changes, including GHG emission reductions. The next generation of regional integrated plans is expected to result in climate benefits well beyond the 2035 time horizon.

Integrated regional planning efforts under SB 375 enable communities to understand the differences between alternative development patterns and to make choices accordingly. Recently approved SCSs reflect regional goals for a more sustainable form of community development that brings with it economic, social, and environmental benefits. The implementation of these regional goals through individual action by local governments and the development community will be essential to meeting the State's ongoing climate objectives. The success of efforts to reduce GHG emissions within other economic or resource sectors such as water, energy, and transportation will be greatly improved by a transition to more sustainable land use practices in the years ahead.

Similarly, California must pursue integrated planning in the freight sector, recognizing that passenger vehicles and trucks share the same transportation system.

C. Investments

Investments in financial incentives and direct funding are critical components for successful implementation of GHG emission reduction strategies. These investments combine with California's regulatory and market-based programs to provide an environment where businesses that make smart investments can be rewarded for developing advanced technologies. Targeted, performance-based standards and technology-forcing rules can kick-start markets and drive technologies to higher volumes, lower prices, and ultimately, to become market-winning solutions, rather than compliance approaches. Strategic financial investments and policy support can accelerate market transitions to cleaner technologies.

102 Dutzik, T., and P. Baxandall. 2013. A New Direction: Our Changing Relationship with Driving and the Implication's for America's Future. U.S. PIRG Education Fund and Frontier Group. Spring.

The initial Scoping Plan contained a comprehensive array of strategies to reduce GHG emissions in California and acknowledged the important role that strategic investments and financial incentives play in moving the State toward the 2020 goal. The initial Plan noted that funding, combined with effective regulatory policies, should help to foster an economic environment that promotes California-based investment and the development of new clean energy. Many of the initial Plan's measures relied on incentives and funding to achieve the full benefits, including energy efficiency, forestry management, and local land use planning.

The State has existing, but limited, incentive programs and it is critical to use these resources effectively to leverage private-sector investment and build sustainable, growing markets for clean and efficient technologies. Some examples include: millions of dollars in rebates for Californians that purchase or lease electric or fuel cell cars; millions of dollars for grants to help diesel truck owners buy cleaner trucks; billions of dollars in assistance to help improve the energy efficiency of homes and businesses; and the potential use of Cap-and-Trade revenue to promote growing clean energy markets.

There are many existing funding programs that work in tandem at the Federal, State, and local levels to achieve GHG emissions reductions and help foster the transition to a clean energy economy. For example, since 2008, the CEC has administered the Alternative and Renewable Fuel and Vehicle Technology Program, authorized under AB 118 (Núñez, Chapter 750, Statutes of 2007) to fund alternative and renewable fuels and advanced transportation technologies and help meet California's climate change goals. The program invests $100 million annually to develop and deploy advanced technology fuels, build fueling infrastructure, purchase clean vehicles, and provide the workforce training that is needed to operate and maintain these new technologies. In addition, ARB administers the Air Quality Improvement Program (AQIP) which is also authorized under AB 118 and continues to provide incentives for zero-emission passenger vehicles, zero-emission and hybrid trucks, and advanced technology demonstrations. These AB 118 programs are critical to meeting California's long-term air quality and climate change goals and have recently been reauthorized through 2023[103] providing about $1 billion in public investments over the next decade to reduce GHG, criteria, and toxic emissions.

Table 7 highlights some of the existing federal, State, and regional incentive programs.

103 Assembly Bill 8, (Perea, Chapter 401, Statutes of 2013).

Table 7: Existing Regional, State, and Federal Incentive Programs

Regional Programs
• Clean truck and bus grants/incentives from local air districts • Urban greening and sustainable development grants from metropolitan planning organizations and local governments • Utility rebates/incentives for energy efficiency and renewable energy • Transit assistance from local governments and transit operators • Water efficiency and wastewater diversion projects via local air, water and sanitation agencies
State Programs
• ARB incentives for clean cars and buses, fuel infrastructure, equipment electrification, and RD&D of sustainable freight technology • CEC incentives, via the Electric Program Investment Charge (EPIC) Program and AB 118, for alternative and renewable energy, alternative fuel technology, energy efficiency, waste-to-energy, and applied research and development for innovative energy technology • CPUC and CSD* energy efficiency, weatherization, and solar projects • Climate dividends for electricity ratepayers • Energy efficiency projects for schools and clean energy jobs via Proposition 39 • SGC/DOT/HCD** grants for sustainable community planning and development • CalRecycle incentives for waste reduction, recycling, and composting, including infrastructure • CAL FIRE/CDFW support for natural resource protection • HCD Transit Oriented Development Housing Program (TOD) • CDFA funding for RD&D of environmentally sound fertilizing materials
Federal Programs
• U.S. EPA incentives reducing mobile source emissions, encouraging smart growth and increasing multi-modal transportation options • U.S. DOE funding for energy efficiency, renewable energy, alternative fuels and vehicles, and alternative fuel infrastructure • U.S. DOT incentives for increased transit opportunities, cleaner fuels, congestion reduction, and multi-modal transportation options • U.S. Department of Housing and Urban Development (HUD) funding for residential energy efficiency and affordable infill development • U.S. Department of Agriculture (USDA) support for rural electricity and bioenergy programs

* (CSD) Community Services & Development, **(HCD) Housing and Community Development;

While the funding resources shown above represent existing programs, the initial Scoping Plan focused on potential State proceeds from the auction of allowances under the Cap-and-Trade regulation. The initial Plan also identified a number of possible investments, including funding energy efficiency and renewable resource development, providing incentives to local government, delivering rebates to consumers, and funding research, development, and deployment.

In 2013, the Brown Administration developed an Investment Plan to guide the investment of State proceeds from Cap-and-Trade auctions—expected to be one of the largest State sources of funding for climate mitigation programs. The Investment Plan was developed to meet the requirements of AB 1532, SB 535, and SB 1018, which provide a framework for how the auction proceeds will be administered, including requirements to spend a percentage of the proceeds within disadvantaged communities and to benefit disadvantaged communities. The Administration's first three-year Investment Plan, which continues through the 2015–16 fiscal year, contained the following investment principles to guide the expenditure of auction proceeds:

- Emphasize investments in existing programs in sectors which have the greatest GHG emissions—transportation, energy, waste, and natural resources—with investments commensurate with relative emissions.
- Maximize economic, environmental, and public health benefits to the State.
- Foster job creation, through promotion of in-state GHG emission reductions carried out by California workers and businesses.

- Complement efforts to improve air quality.
- Direct investments toward the communities and households disproportionately burdened by multiple sources of pollution.
- Provide additional opportunities to businesses, public agencies, nonprofits, and other community institutions to participate in and benefit from statewide efforts to reduce GHG emissions.
- Lessen the impacts and effects of climate change on the State's communities, economy, and environment.

ARB will outline multi-year auction proceeds investment strategies every three years as part of the required updates to the Cap-and-Trade Auction Proceeds Investment Plan.

Building upon the results of the public process and multi-agency effort for the first three-year Investment Plan, the Governor's proposed January budget for fiscal year 2014-2015 (Proposed Budget) presented auction proceeds investments in existing State programs that support California's ongoing effort to reduce GHG emissions and promote a more energy-efficient California. The Proposed Budget included a balanced portfolio of $850 million in initial investments for GHG emission reductions and benefits to disadvantaged communities, as directed by SB 535 (De León, Statutes of 2012), in the transportation, energy, waste, and natural resources sectors.

An important element of auction proceeds investment will be identifying and funding projects that meet or exceed the requirements in SB 535, which states that at least 25 percent of funding provide benefits to disadvantaged communities and at least ten percent of funding be allocated to projects located in disadvantaged communities. Over the last year, the Administration has received comments with varying interpretations of how an investment can benefit disadvantaged communities. To ensure consistent implementation of SB 535, ARB will develop guidance for administering agencies, including what qualifies as a benefit to disadvantaged communities. ARB will solicit public input on this guidance and the SB 535 specific elements. Informed by the public process, ARB will also work with implementing agencies to define how those benefits can be quantified, tracked, and reported. Table 8 provides a preliminary timeline for the SB 535 implementation process.

Table 8: Proposed SB 535 Implementation Process

Activities	Preliminary Timeframe
• Develop preliminary guidance, including what it means for an investment to benefit a disadvantaged community • Solicit public input on SB 535 implementation	Summer 2014 to Winter 2015
• Quantify and report on benefits to disadvantaged communities • Revise SB 535 guidance as needed and as new investments are made	Each year

Continued investment in existing programs with established success in reducing GHG emissions will help maintain the 2020 limit. However, extensive additional innovative strategies and funding sources are needed in sustainable community planning and development, clean transportation, clean energy, energy efficiency, water efficiency, agriculture, natural resources, and waste diversion to achieve deeper emissions reductions.

For the near-term, funding is needed to fill information gaps and analyze the trade-offs associated with different policy choices and technologies. These strategic investments can be made now to demonstrate and identify projects with long-term environmental and economic benefits for California. For example, investment in research to develop improved fertilizer management practices has the potential to result in larger-scale strategies that can reduce GHG emissions while maintaining or enhancing crop yields.

On the transportation side, as part of 2013-14 State Budget, Governor Brown charged the California State Transportation Agency with identifying California transportation needs and long-term funding sources. Per this direction, in April 2013, the California State Transportation Agency formed the California Transportation Infrastructure Priorities Workgroup (CTIP) to help set priorities for transportation spending and explore long-term funding options to support California's infrastructure needs. In February 2014, the CTIP released a visioning document for the next ten years of California's transportation infrastructure that recognized the need to continue to seek consensus and implementation on viable long-term, dedicated, funding such as increased local revenue, mileage-based user fees, toll facilities and lanes, and others.

The availability of dedicated and long-lasting funding sources, such as those identified by the CTIP, helps provide certainty and additional partnership opportunities at the State, regional, and local levels for further investing in projects that have the potential to reduce millions of metric tons of GHGs, such as sustainable communities, transit infrastructure, energy conservation, renewable energy, and natural resources projects.

Funding available to support AB 32, whether from short or long-term sources, should be primarily focused on programs that (1) reduce GHGs or short-lived climate pollutants, (2) are consistent with state climate strategies, and (3) provide co-benefits such as job creation and better air quality. As an example, investments in urban forestry projects administered by Local Conservation Corps are identified in the Investment Plan and can provide economic and educational co-benefits combined with long-term carbon sequestration and GHG emission reductions. Table 9 describes the types of funding that support the purposes of AB 32 and provide valuable co-benefits.

Table 9: Funding of Specific Areas to Support AB 32

- Expansion of established programs:
  - affordable transit-oriented development (TOD) and infill housing development that cut VMT
  - local, regional, and state funding programs supporting transit, infrastructure, active transportation (walking/biking), land-use changes, and other projects that place a priority on reducing VMT and GHG emissions and are identified in the Sustainable Community Strategies or Regional Transportation Plans
  - rebates and grants for zero and near-zero emission vehicles, trucks, and buses
  - funding for goods movement and other mobile source advanced technology demonstration/deployment projects
  - residential energy efficiency financing mechanisms
  - weatherization and building energy efficiency upgrades
  - residential solar retrofits
  - incentives for small-scale energy storage systems and smart-grid technology to support zero-net energy buildings
  - water efficiency/conservation
  - industrial and agricultural operational energy efficiency
  - diesel pump replacement and electrification
  - Recycling Market Development Zones loans
  - organic waste reduction, recycling, and increased composting to turn waste into a resource
- Infrastructure investments that are integrated with sustainable community plans, maximize transit trips, and cut VMT
- Partnerships with local programs, such as the California Green Business Program, which promote and improve environmental practices within businesses to reduce GHG emissions
- Rail modernization efforts that grow transit ridership, improve mobility across the State, and reduce GHG emissions
- Wide-scale implementation of sustainable freight transport strategies and other mobile source strategies
- Research, development, and deployment for projects that have the potential to further reduce or sequester GHG emissions, such as low-emission distributed generation, advanced energy storage, renewable/low carbon fuels, and carbon capture, utilization, and sequestration
- Low carbon bioenergy, including developments in second-generation biofuels
- Urban forestry, forest, and biomass energy projects that result in a net increase in carbon stocks
- Agricultural and rangeland efforts to reduce or minimize GHG emissions through fertilizer and amendment strategies, soil management practices, and land conservation and management aligning with SB 375 and AB 32 goals
- Water conservation and efficiency
- Wetlands, rangelands, and other land use efforts to minimize GHG emissions or increase net sequestration
- Commercialization of low-/lower-GWP gas alternatives for existing high -GWP gases

Looking forward, the State will need to make targeted, priority investments with the limited funding available. California will need to continue coordinating and utilizing funding sources such as the Greenhouse Gas Reduction Fund[104] (auction proceeds), the Alternative and Renewable Fuel and Vehicle Technology Program (AB 118), Electric Program Investment Charge (EPIC) Program, and the Proposition 39: Clean Energy Job Creation Fund to expand investments in California's clean economy and further reductions in both GHG emissions and short-lived climate pollutants. For example, the State can use auction proceeds to provide rebates that encourage consumers to purchase zero- and near-zero emission vehicles. This effort can be coordinated with CEC AB 118 investments for the installation of charging infrastructure to help meet the objectives of AB 32 and move the State to the widespread adoption of zero-emission vehicles needed to achieve ongoing climate and air quality goals.

D. Expanding Climate Actions

California's achieved success of reducing emissions while supporting economic growth and improving quality of life creates another leading policy regime in California that others necessarily want to follow.

Engaging with other governments is critical to expanding action to address global climate change and maximizing benefits to California. Fostering broad action on the global scale is critical to minimize the impacts of climate change on California, reach sectors that California policy has a hard time affecting, and scale markets for clean technologies, including California products. California and other leading national and subnational jurisdictions are working to expand action to reduce emissions and combat climate change and share best practices in order to maximize the efficiency and benefits of doing so.

Successful climate action does not start or end with government, however. It depends on how we interact with our built and natural environments. It depends on how businesses create value and interact with customers. Ultimately, it depends on the choices we each make. A critical element of California's strategy to achieve climate policy success is remaining flexible, facilitating local and private sector leadership, and providing a greater array of choices for consumers that include cleaner technologies and lower carbon lifestyles.

1. Support Sustainable Choices by Households and Businesses

The choices that we make—where we live, how we travel, what we purchase—have significant impacts on energy use and GHG emissions. Individuals and businesses play critical roles in addressing climate change. According to a recent Lawrence Berkeley National Laboratory (LBNL) study,[105] changes in behavior can result in 8 to 17 percent energy savings. Moving forward, it will be essential to expand the range of options Californians have to live sustainable, healthy lives.

Through policies implemented under AB 32, California is offering consumers more choices. This is materializing in just about every area of our lives that is touched by the way we use energy and is illustrated by the examples below:

- **Cars and trucks:** We have an expanding array of choices in the cars and trucks that we drive. There is now a wide, and growing, range of efficient and zero emission vehicles in showrooms.
- **Alternatives to driving:** Those who want an alternative to driving or vehicle ownership are finding more alternatives, as local governments design their communities to accommodate more walking, biking, and public transportation and businesses pioneer new mobility models.
- **Fuels:** Drivers can now pick from fossil or bio-based gasoline and diesel, ethanol, electricity, natural gas, renewable natural gas, or hydrogen.

104 AB 1532 (Pérez, Chapter 807), SB 535 (De León, Chapter 830), and SB 1018 (Senate Budget Committee, Chapter 39) established the GHG Reduction Fund to receive Cap-and-Trade auction proceeds.

105 Wei, M., J. H. Nelson, M. Ting, and C. Yang. 2012. California's Carbon Challenge: Scenarios for Achieving 80% Emissions Reduction in 2050. Lawrence Berkeley National Laboratory.

- **Energy in the home:** Homes and appliances are more energy efficient, delivering more comfort for less cost. Consumers have more control over how and when they use energy, how much it costs, and where it comes from. New home buyers can pick among an array of energy options, including various levels of efficiency and solar.
- **Business productivity:** Businesses are improving productivity and delivering more value with lower energy use and emissions. They have more options for cutting their energy costs and getting products to market quickly and efficiently. And they are leading on distributed generation deployment and clean energy investment.

Always, California's climate policies and programs need to leverage and enable its citizens and businesses to innovate and further reduce GHG emissions.

2. Enable Local and Regional Leadership

California's local and regional governments are critical partners in meeting the State's GHG goals. They have broad influence and, in some cases, sole authority over activities that contribute to GHGs and air pollutants, including industrial permitting, land use and transportation planning, zoning and urban growth decisions, implementation of building codes and other standards, and control of municipal operations.

Local and regional governments are uniquely positioned to collaborate to affect GHG emission reductions on a larger scale. As cities and counties fall into a larger regional framework, they are working together to create synergistic relationships for reductions through land use and transportation networks, as well as within specific sectors, such as energy.

Local air pollution control and air quality management districts (districts) have a key role to play in reducing regional and local sources of GHG emissions. Because many actions to reduce air pollutants also reduce GHG emissions, many districts are actively integrating climate protection into air quality programs. Districts also support local climate protection programs, by providing technical assistance and data, quantification tools, and even funding. In addition, districts can be key players in regional cross-media collaborations to mitigate and adapt to climate change. The California Air Pollution Control Officers' Association, and its 34 local air district members, prepared a detailed discussion of local and regional efforts to mitigate climate change; this document is included as Appendix D.

Since the approval of the Scoping Plan, local and regional governments throughout California have increasingly pursued efforts to reduce GHG emissions across sectors. The passage of SB 375 has accelerated regions toward the development of more integrated, sustainable regional transportation plans that, if implemented, could reduce passenger vehicle emissions and bring about substantial co-benefits. So far, each of the major metropolitan planning organizations (MPOs) that have adopted SCSs has demonstrated that it could meet its region's emission reduction targets under SB 375.

Local governments have initiated efforts to reduce GHG emissions beyond those required by the State. Local governments are improving their municipal operations by upgrading their vehicle fleets, retrofitting government buildings and streetlights, purchasing greener products, implementing waste-reduction policies, and more. In addition, they are adopting more sustainable codes, standards, and general plan improvements to reduce their community's emissions. For instance, localities are implementing landscaping ordinances to reduce water use, streamlining permitting for small-scale renewable energy systems, requiring commercial buildings to be retrofit on resale, and updating General Plans to improve transportation mobility options and land use decisions. Regions throughout California are also supporting innovative programs and technologies—supporting the accelerated adoption of advanced vehicle technologies and programs, creating innovative financing options for residents to retrofit their homes, and pursuing their own alternative energy sources. To maximize success in reducing

GHG emissions and promoting sustainability within communities, local governments are creating integrated planning processes and are developing innovative regional collaborations that extend beyond government agencies to include utilities, universities, labor, and leadership from business and community groups.

While the Scoping Plan encouraged local governments to adopt GHG emission reduction goals consistent with those of statewide targets, many local governments had already initiated their own locally driven climate action efforts. By late 2011, 27 percent of California's cities and counties—representing 50 percent of the state's population—were signatories to the U.S. Conference of Mayors Climate Protection Agreement or the Sierra Club's "Cool Counties" program.[106] By September 2013, 76 California local governments had joined the International Council for Local Environmental Initiatives' Climate Protection Campaign—representing 57 percent of the State's population.[107] Today, locally driven climate actions continue to increase among local governments. According to a recent survey, roughly 70 percent of California jurisdictions have either completed policies or programs to reduce GHG emissions or are in the process of adopting them.[108] While many local governments have become leaders in sustainability, there remains significant opportunity for many local governments to take meaningful action.

A number of tools and resources have been developed to assist local climate action planning. These include:

- The local Government Operations Protocol, which provides a standard GHG emission inventory methodology for municipal operations.
- The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.
- Climate action plan templates and monitoring and tracking tools developed through the Statewide Energy Efficiency Collaborative in coordination with ARB and OPR.

Many of these tools can be found on the *CoolCalifornia.org* website, which also houses climate action tools and resources for businesses, schools, and individuals.

106 Bedsworth, L. W., and E. Hanak. 2013. "Climate policy at the local level: Insights from California." Global Environmental Change 23: 664–677.
107 ICLEI Local Governments for Sustainability membership status as of September 2013.
108 Office of Planning and Research. 2012. Annual Planning Survey Results 2012. *www.opr.ca.gov/docs/2012_APSR.pdf*.

SUCCESS STORY

COOLCALIFORNIA
CITY CHALLENGE

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CoolCalifornia City Challenge

To engage communities in reaching the State's climate goals, the Air Resources Board sponsored a pilot project, the CoolCalifornia Challenge. Conducted by the University of California, Berkeley, the Challenge was a yearlong competition between California cities to reduce the carbon footprints of residents and build more vibrant and sustainable communities. Using lessons from successful community-based social marketing programs that motivate individuals to take climate action through peer-to-peer capacity building and leadership, the Challenge inspired over 225 metric tons of greenhouse gas emission reductions by over 2,600 participants in its eight participating cities, equivalent to taking 95 California homes off the electrical grid for one year.

To enable local and regional leadership to further reduce GHG emissions beyond State programs and policies, California must always provide a supportive framework to advance community-wide, voluntary efforts. In addition to reducing emissions across sectors, many of these activities also can bring benefits to households and businesses, create more sustainable lifestyles, and help our communities thrive.

Community-wide Emissions Reduction Target

Recognizing the important role local governments play in the successful implementation of AB 32, the initial Scoping Plan called for local governments to set municipal and community-wide GHG reduction targets of 15 percent below then-current levels by 2020, to coincide with the statewide limit. As California continues to build its climate policy framework, there is a need for local government climate action planning to adopt mid-term and long-term reduction targets that are consistent with scientific assessments and the statewide goal of reducing emissions 80 percent below 1990 levels by 2050. Local government reduction targets should chart a reduction trajectory that is consistent with, or exceeds, the trajectory created by statewide goals. Improved accounting and centralized reporting of local efforts, including emissions inventories, policy programs, and achieved emission reductions, would allow California to further incorporate, and better recognize, local efforts in its climate planning and policies.

Local Government Financing Mechanisms and Incentives

The development of long-term revenue streams and creative local financing mechanisms and incentives can accelerate emission reductions. For instance, local financial incentives can spur retrofits of the existing building stock, net-zero energy or carbon projects, and other voluntary GHG emission reductions. The expansion of PACE financing programs, the creation of incentive opportunities under various policies and planning efforts, and the formation of new mechanisms are all options that should be explored to continue progress toward reducing emissions across our communities.

3. Coordinate with Subnational, Federal, and International Partners

California has established itself as a national and international leader in addressing and combatting climate change. The release of the initial Scoping Plan strengthened the State's commitment to address climate change, but California is not alone. Reducing the risks of climate change requires effective action among all the world's major GHG emitters. Recognizing the interconnected and multi-jurisdictional nature of climate change, California has established a wide range of partnerships, both within and beyond its borders, to promote its own best practices and learn from others while further leveraging the State's leadership in climate protection.

California's efforts on clean energy and climate policy have been successful in leveraging action at the interstate, federal, and international levels. Through collective efforts such as the Western Climate Initiative (WCI) and other alliances of states, California is taking action to expand emission reduction programs and build resiliency against climate change impacts. At the federal level, many of California's policies and programs have served as models for action. California has developed climate solutions with key federal agencies, including the U.S. Department of Energy (U.S. DOE), U.S. EPA, U.S. Department of Transportation (U.S. DOT), and others. Internationally, California is engaged in consultation and collaboration with both national and subnational jurisdictions to share best practices, build capacity, and pioneer new policy tools. These activities are assisting in implementing and strengthening a variety of climate programs around the world.

Efforts in all of these areas are consistent with the State's long-standing leadership in environmental protection and leadership. Coordinating and promoting climate action at the interstate, federal, and international levels is necessary to adequately address climate change, expand clean energy and economic development, and enhance the competitiveness of the State's businesses, workers, and economy.

Interstate Partnerships

California has a long history of working with other states on environmental protection. Continuing this practice and recognizing the value in broad collaborative action to reduce GHG emissions, the State has reached beyond its borders to enlist its neighbors in joint climate-change efforts and promote interstate action.

With the adoption of the initial Scoping Plan, California became the first state in the nation to formally approve a comprehensive GHG emission reduction plan that involves every sector of the economy. Today, several states and cities are following suit and achieving real emission reductions and gaining valuable policy experience as they take action on climate change.

Through participation in interstate initiatives and partnerships with other states, California continues to promote its own best practices and learn from others while finding solutions to reduce GHG emissions, develop clean energy sources, and achieve other environmental and economic goals. Specific examples of these ongoing efforts include:

- Coordination with the WCI on Cap-and-Trade.
- Ongoing consultation with the Regional Greenhouse Gas Initiative, a forum for leadership and information sharing and a common voice on issues faced by the region.
- An agreement with the Pacific Coast Collaborative partners (California, Oregon, Washington and British Columbia) to develop coordinated approaches to reduce GHG emissions, including setting mid-term climate targets, pricing carbon, developing Low Carbon Fuel Standards, and developing an alternative fuels plan for the heavy-duty sector.

Federal Collaborations

In June 2013, President Obama approved the nation's first Climate Action Plan that lays out a series of executive actions to reduce carbon pollution, prepare the nation for the impacts of climate change, and lead international efforts to address global climate change.

California has worked closely with key federal agencies to ensure that the federal approach is consistent with California's stringent standards, as well as the programs in other states that have been leaders in climate protection. Examples of successful collaboration between California and the federal government include the following:

- ARB worked with U.S. EPA and NHTSA to harmonize federal light-duty vehicle standards with California's existing standards through 2016.
- ARB worked with U.S. EPA and NHTSA to develop the first-ever federal GHG standards for medium- and heavy-duty vehicles.
- ARB and U.S. EPA routinely coordinate on advanced transportation and fuels, including the relationship between the federal Renewable Fuels Standard and California's LCFS.
- ARB and the U.S. Department of State routinely coordinate on common issues between California's climate programs and the negotiations under way at the United Nations Framework Convention on Climate Change.
- In January 2012, Governor Brown signed a memorandum of understanding (MOU) with U.S. Department of Interior Secretary Ken Salazar to expand a state and federal partnership that has paved the way for more than a dozen utility-scale solar energy projects and more than 130 renewable power projects in California.

Currently, California is engaging with U.S. EPA and others in the development of national GHG emission standards for power plants under the federal Clean Air Act. As U.S. EPA moves forward to set standards, California is well positioned to respond based on our pioneering actions on climate and air quality.

California is committed to working with the federal government as it implements the President's Climate Action Plan. This commitment includes ensuring that actions the State has already taken to cut emissions will be reflected in subsequent federal actions.

International Engagement

As one of the largest economies in the world and a leader on addressing climate change, California is committed to working at the international level to reduce global GHG emissions. As part of this effort, California has engaged in consultation and collaboration with both national and subnational jurisdictions to share best practices, build capacity, and pioneer new policy tools. These activities are successfully assisting in implementing and strengthening a variety of climate programs around the world, in turn supporting the ability of both developing and developed countries to make more meaningful climate commitments under both the United Nations Framework Convention on Climate Change and bilateral agreements.

California also engages in multi-lateral forums that help develop the policy foundation and technical infrastructure for GHG regulations in multiple jurisdictions. Recognizing that many efforts were under way around the world to use market forces to motivate GHG emission reductions, California worked with other governments to establish the International Carbon Action Partnership (ICAP) in 2007. The ICAP provides a forum for sharing experiences and knowledge among jurisdictions that have already implemented or are actively pursuing market-based GHG programs.[109]

Similarly, and recognizing the need to address the substantial GHG emissions caused by deforestation and degradation of tropical forests, California worked with a group of subnational governments to form the Governors' Climate and Forests Task Force (GCF) in 2008.[110] The GCF is currently comprised of 22 different subnational jurisdictions, including states and provinces from Brazil, Indonesia, Mexico, Nigeria, Peru, Spain, and the U.S. that are contemplating low-emissions development policies and programs, such as REDD. These include addressing forest-related emissions and sharing experiences on how such programs could potentially interact with carbon markets, including California's Cap-and-Trade Program. Ongoing engagement between California and its GCF partners, including with more advanced jurisdictional programs, such as Acre (Brazil), and emerging programs in Chiapas (Mexico) and elsewhere, as well as ongoing discussions with other stakeholders, will provide lessons on how such programs could fit within California's Cap-and-Trade Program. Furthermore, REDD is a key topic within the United Nations Framework Convention on Climate Change and between national and subnational jurisdictions, including through collaboration between California and the U.S. Department of State. Continued evaluation of REDD and other sector-based offset programs further demonstrates California's ongoing climate leadership and could result in partnering on other mutually beneficial climate and low emissions development initiatives, particularly those in Mexico.

In April 2013, Governor Brown led a delegation of California government and business leaders to Beijing and several Chinese provinces. California signed Memorandums of Understanding (MOUs) pledging direct cooperation in developing clean technology, pollution reduction, and climate mitigation policies and markets with the Beijing Environmental Protection Bureau, the Ministry of Environmental Protection, and Guangdong Province. In June 2013, California and Shenzhen, China, signed an MOU to work together to share policy design and early experiences from their climate trading programs. In July 2013, California and Australia signed an MOU to guide collaboration between the agencies in addressing the global issue of climate change.

More recently, Governor Brown signed the first agreement of its kind between a subnational entity and China's National Development and Reform Commission to expand bilateral cooperation on climate change. The Memorandum of Understanding is intended to boost

109 International Carbon Action Partnership Website: *http://icapcarbonaction.com/*.
110 Governors' Climate and Forests Task Force Website: *www.gcftaskforce.org/*.

bilateral cooperation on climate, clean energy, and development, and sharing of low-carbon programs and policies. In his 2014 State of the State address, the Governor announced his intention to work with Mexico on climate change.

As California continues to engage at all these levels and share its experiences, policy programs, and leading approach to climate change, we will also seek new partners to expand global action to address climate change, minimize its impacts, and deliver benefits to our State.

VI. Evaluations

Continuing to effectively build upon California's climate framework and ensuring successful implementation of the State's policies requires periodic monitoring and program evaluation, so that programs can be built upon, adapted, and enhanced – as appropriate – to continue driving down emissions well into the future. California will continue to evaluate the economic, environmental, and public health impacts of its set of climate policies to inform its ongoing activities to reduce emissions. Importantly, the State is committed to ensuring an equitable distribution of benefits from its climate programs, and will continue monitoring impacts in environmental justice communities and target programs and investments where appropriate to enhance benefits in disadvantaged communities.

This chapter discusses the economic, public health, and environmental justice evaluations that will be conducted as the Scoping Plan continues to be implemented. It also discusses the environmental analysis that was prepared of this Update.

A. Economic Analysis

In California, the implementation of Scoping Plan measures is under way but still in the early stages, presenting challenges in the ongoing assessment of the economic impacts of AB 32. While comprehensive in regulatory scope and scale as indicated below, the net impact of AB 32, even after full implementation, is estimated to be small in relation to the $2 trillion California economy,[111] making it difficult to isolate its economic impact. In addition, the global recession and California's subsequent recovery complicate the evaluation of the economic impact of the suite of regulatory measures that are being implemented under AB 32. This challenging economic landscape requires careful analysis of the costs and benefits of AB 32 on industries and individuals in California. The assessment can inform the design and refinement of cost-effective actions California can take toward its long-term climate goals.

As California emerges from the recession, the overall impact of AB 32 remains unclear, and many questions remain unanswered. How has AB 32 impacted economic growth? Has AB 32 spurred innovation and economy-wide growth? How have the impacts of Scoping Plan measures been distributed among businesses and Californians? These questions and others are critical in the accurate assessment of the economic impacts of AB 32 and are the driving force in a multi-pronged approach to the analysis of the economic costs and benefits of AB 32.

Prior to the implementation of regulatory measures under AB 32, the anticipated micro- and macroeconomic costs of the suite of regulatory measures were estimated. Now California turns to the next stage of analysis that consists of estimating the aggregate costs of measures already implemented and analyzing their distributional impacts across businesses and individuals in California and beyond.`

111 Center for Continuing Study of the California Economy. *www.ccsce.com/PDF/Numbers-July-2013-CA-Economy-Rankings-2012.pdf*.

Moving forward, the assessment of the economic impact of AB 32 is divided into two phases: (1) the continued estimation of regulatory costs as measures are implemented, and (2) an ex post analysis of the macro- and microeconomic impacts of AB 32. As California prepares for a retrospective ex post analysis in subsequent Scoping Plans, the State continues to assess whether the economic costs of the implementation of AB 32 are in line with ex ante estimates of costs. In the first phase of the assessment, State agencies are monitoring the costs of AB 32 regulatory measures. In the second phase of the assessment, State agencies will collaborate with external economic experts, researchers, and stakeholders in the design, development, and implementation of rigorous micro- and macroeconomic assessments of the ex post economic impact of AB 32.

The following sections outline the assessments of economic impacts that occurred prior to the implementation of AB 32, the assessments that will occur once AB 32 measures are more fully implemented, and the assessments of economic impacts that are currently under way.

Ex Ante Assessment of Potential Costs and Benefits

Section 38561 of AB 32 requires State agencies to evaluate the total potential costs, as well as the total potential economic and non-economic benefits of the Scoping Plan using the best available economic models and emission estimation techniques.[112] Pursuant to AB 32, ARB conducted two full-scale analyses, as part of the 2008 Scoping Plan and 2010 Updated Economic Analysis of the Scoping Plan, to assess the potential economic impacts of the portfolio of Scoping Plan measures on the California economy. In addition, four external general equilibrium analyses have been conducted.

The two internal and four external macroeconomic analyses estimated the overall potential impact of AB 32 on California gross state product to range from an increase of 1.0 percent to a decline of 2.2 percent in 2020.[113] The models and modeling approaches underlying the

112 The AB 32 text is available at *www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf*.

113 The six analyses include analyses conducted by ARB, David Roland-Holst, the Electric Power Research Institute, and Charles River Associates. These analyses can be accessed at: ARB. 2008. Climate Change Scoping Plan. *www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf*;

SUCCESS STORY

California Local Governments

Local governments are in many ways the "boots on the ground" for meeting California's climate change goals, beginning with their local planning efforts. Municipalities use a number of frameworks to outline their goals and implementation strategies for reducing greenhouse gases. According to 2012 OPR's Annual Planning Survey, about 90 local governments have adopted policies and/or programs to address climate change, often in the form of Climate Action Plans. Moreover, over 270 local governments reported they were making progress towards adopting climate change policies. As of October, 2013, 135 California mayors have voluntarily signed the U.S. Conference of Mayors Climate Protection Agreement, which strives to meet or beat the Kyoto Protocol reduction targets.

six analyses vary in terms of structure and inputs, yet they yield a generally similar conclusion on the economy-wide impact of AB 32.[114] The analyses also identified the impacts of AB 32 on certain industrial sectors in California. These results led to program modifications—most notably the inclusion of output-based allocation for industrial entities in the Cap-and-Trade Program.

In addition to identifying the impact of AB 32 when all implemented measures achieve expected emission reductions, in the 2010 Updated Economic Analysis of California's Climate Change Scoping Plan ARB estimated the economic impact of reaching the near-term emission limit in 2020 should measures not provide anticipated GHG emission reductions.[115] Within the five sensitivity cases developed in the analysis, the overall costs of reaching the near-term emission limit in 2020 were minimized when all measures, as currently being implemented, achieve their anticipated GHG emission reductions. Scenarios in which AB 32 measures related to energy efficiency, transportation, and renewable energy fall short of expected emission reductions result in an increase in the overall cost of AB 32, as additional, less cost-effective emission reductions are required from the remaining measures to meet the 2020 emission limit. This sensitivity analysis highlights the need to monitor the GHG emission reductions and costs of individual measures to identify the overall costs of the suite of AB 32 regulatory measures.

While robust analyses have estimated the potential, or ex ante, economic impacts of AB 32 prior to implementation, more data and analysis is necessary to determine the realized, or ex post, impacts of the regulatory measures on California's industries, businesses, and consumers. In addition, the range of potential economic impacts identified in the six macroeconomic analyses highlights the challenge in parsing the effects of AB 32 from other macroeconomic conditions in the California economy. The recent economic recession and recovery, as well as the presence of overlapping local, State, and federal regulations present challenges in the identification of a "business as usual" baseline against which to evaluate the impacts of AB 32.

The macroeconomic ex ante analyses provide important information; however, the models used in these assessments are often highly aggregated and lack specific detail about individual industries or technologies. Greater detail is important for assessing the potential economic impact of individual regulatory measures that is required under the Administrative Procedure Act (APA). Section 11346.2 of the APA requires as part of the Initial Statement of Reasons (ISOR) an assessment of the benefits and costs of any proposed or amended regulation.[116] For regulatory measures adopted under AB 32, assessments of the costs and benefits have been included as part of the regulatory package. These assessments require gathering sector-specific information regarding the engineering and economic costs of regulatory compliance on businesses and estimating the indirect and induced impacts of these costs, as well as the corresponding expected environmental benefit. While the scale, scope, and assumptions used in these assessments are regulation-specific, these industry-level calculations provide additional data outlining the projected costs and benefits of AB 32.[117]

ARB. 2010. Updated Economic Analysis of California's Climate Change Scoping Plan. *www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf*; Roland-Holst, David. 2008. Economic Analysis of California Climate Policy Initiatives Using the Berkeley Energy and Resources (BEAR) Model (Appendix G-III). *www.arb.ca.gov/cc/scopingplan/document/appendices_volume1.pdf*; Roland-Holst, David. 2010. Climate Action for Sustained Growth: Analysis of ARB's Scoping Plan. *www.arb.ca.gov/cc/scopingplan/economics-sp/meetings/042110/rolandholst.pdf*; Electric Power Research Institute. 2007. An Updated Macroeconomic Analysis of Recent California Climate Action Team Strategies. *www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001015510*; Charles River Associates. 2010. Analysis of the California ARB's Scoping Plan and Related Policy Insights. *http://crai.com/uploadedFiles/analysis-of-ab32-scoping-plan.pdf*.

114 The internal ARB and external analyses differ, most notably, in assumptions related to emissions leakage, the rate of technological change, input substitution, costs of VMT, and economic growth in the "Business as Usual" scenario.

115 Table 12 outlines the sensitivity cases considered in the analysis and is available at: *www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf*

116 The APA text is available at *www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=11001-12000&file=11346-11348*.

117 Regulatory documents are available through ARB's Climate Change Programs at *www.arb.ca.gov/cc/cc.htm*.

Ex Post Assessment of Realized Costs and Benefits

In the years since the analyses of potential economic impacts were conducted, California has moved from the assessment of projected impacts to the implementation of measures outlined in the Scoping Plan and planning the ex post estimation of realized costs and benefits. California has two objectives in the assessment of the ex post economic impacts of AB 32: (1) estimating the overall costs and benefits of the suite of AB 32 measures on the California economy, and (2) identifying the distribution of impacts on industry, small businesses, households, environmental justice communities, and the public sector. California agencies are currently designing a work plan to guide this two-prong approach, including the time line, data requirements, and appropriate methodology for the objective. The work plan will be developed and made publicly available in 2014.

The overall economic impact of AB 32 on the California economy is dependent in large part on the performance of specific measures, including the Renewables Portfolio Standard (RPS), Advanced Clean Cars, Low Carbon Fuel Standard (LCFS), high global warming potential gas measures, and the Cap-and-Trade Program. The costs and benefits of these measures will be fully realized only after the measures reach full stringency. Thus, while the ex post work plan is under development, the full ex post analysis will be conducted in the coming years. As economic impacts may not be immediately realized upon implementation, delaying the assessment also allows for the analysis of lagged economic indicators such as structural changes in employment and production, including the global competiveness of California businesses.

Economic Advisors

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In pursuit of guidance, ARB has engaged a group of Economic Advisors to assist in the development of the work plan to achieve the first objective and estimate the ex post economic impact of AB 32. The Advisors are helping to identify the metrics and methodologies that are best suited to identify the overall costs and benefits of AB 32. More details on macroeconomic modeling of the overall impact of AB 32 and ex post analysis will be included in future updates to the Scoping Plan.

During the implementation of AB 32, California has been collecting data toward the second objective of the ex post assessment—identifying the distributional impacts of AB 32. Through mandatory requirements and voluntary reporting, facility-level data are being collected, and California is beginning the process to analyze, both internally and externally though contracted researchers, how putting a price on carbon changes the behavior and economic health of California businesses and individuals. The data will be used to inform microeconomic models estimating the direct and indirect costs of AB 32, including expenditures on energy, capital, and labor. This analysis will allow the impacts of AB 32 to be quantified over a variety of time horizons, geographic regions, industrial sectors, and income groups, and will provide flexibility in the interactions of regulatory policies. Further, California will continue to track technological developments and the various pathways that industries use to comply with environmental regulations in order to better understand program costs.

The ex post assessment of economic impacts will also inform the design of California's long-term climate change regulatory portfolio. Estimating the economic impact of the current suite of AB 32 measures will provide guidance in establishing long-term emission targets. Assessing the costs and environmental benefit of each regulatory measure over time can lead to modifications

of specific measures as well as the mix of programs within AB 32. This will ensure that the interaction of regulatory measures achieves the goals of AB 32. Thus, the ex post assessment can inform the scope, scale, and stringency of measures in the climate change mitigation portfolio to achieve California's long-term emission targets.

Ongoing Economic Assessment

In addition to the longer-term objectives of the ex post assessment, there are analyses under way to estimate the facility-level regulatory costs and benefits of AB 32 on specific sectors, to inform near-term regulatory modifications. Currently, two analyses are under way at ARB to assess the ability of industrial entities in the Cap-and-Trade Program to maintain competitiveness while incorporating the carbon price into their production processes. In each analysis, external researchers are reevaluating the leakage classification, a measure of the energy intensity and trade exposure of an industrial sector, of California producers using facility-level data on energy consumption, trade flows, and market transfers.[118] The results of the leakage analyses will be used to inform the level of transition assistance needed to minimize leakage in the industrial sector in the third compliance period of the Cap-and-Trade Program. Results are expected by 2016.

External research has also informed the longer-term design of measures under AB 32— most notably the Cap-and-Trade Program and the LCFS—to identify the link between program design and the California economy. For example, the Market Simulation Group (MSG) was established under contract to inform ARB on issues pertaining to market rules and efficiency. It has provided input in assessing program costs, as well as the supply and demand for allowances in the Cap-and-Trade Program.[119] In addition, ARB co-sponsored a symposium in 2012 that brought together economic researchers and regulators to identify the metrics required for the effective analysis of the Cap-and-Trade Regulation.[120] Academic researchers are also providing input to ARB on the design of the LCFS and the near-term cost of compliance.[121] Discussions between regulators and expert economists has spawned ongoing research that is helping to inform the work plan for the ex post analysis of AB 32.

California agencies have also actively engaged the general public and stakeholders to ensure that the economic costs of AB 32 measures are not overly burdensome to specific sectors or income groups. ARB has conducted workshops on the economic costs of LCFS and the Cap-and-Trade Program and solicited comments on internal white papers discussing potential options for cost containment.[122] Gaining insight into the economic market conditions faced by stakeholders allows for the more accurate modeling of economic impacts under AB 32 and provides a measure of some of the compliance costs faced by covered entities.

Along with the collection of data and the active engagement of researchers and stakeholders, ARB is also monitoring the impact of AB 32 on the supply and demand of energy in California. Partnering with the Federal Energy Regulatory Commission (FERC) and CAISO, ARB is monitoring energy and fuel markets to identify the impact of AB 32 on energy markets and the wholesale energy costs faced by industrial, commercial, and residential consumers.[123] These analyses will assist ARB in identifying areas in which to improve the design and stringency of Scoping Plan measures in order to achieve AB 32 emissions goals with minimal economic impact.

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118 Stephen Hamilton of Cal Poly San Luis Obispo and a team of researchers from UC Berkeley are conducting an analysis on the food processing sector, while Meredith Fowlie of UC Berkeley and a team of researchers from Stanford, Resources for the Future, and Clark University are conducting an analysis that covers all remaining industrial sectors. The results of these analyses will be publically available on the ARB website upon completion.

119 The draft analysis is available at *http://ei.haas.berkeley.edu/pdf/Forecasting%20CA%20Cap%20and%20Trade.pdf*.

120 More information is available at *www.bren.ucsb.edu/events/AB32.htm*.

121 The analysis of the LCFS and compliance costs is available at *www.des.ucdavis.edu/faculty/Lin/California_LCFS.pdf*.

122 The LCFS white paper is available at *www.arb.ca.gov/fuels/lcfs/regamend13/20130522ccp_conceptpaper.pdf*; the Cap-and-Trade Program white paper is available at *www.arb.ca.gov/cc/capandtrade/meetings/062513/arb-cost-containment-paper.pdf*.

123 More information is available at *www.caiso.com/Documents/2013SecondQuarterReport-MarketIssues_Performance-Aug2013.pdf* and *www.ferc.gov/EventCalendar/Files/20121220111740-A-4-Presentation.pdf*.

Achieving Near-Term and Long-Term Goals

The Cap-and-Trade allowance price can be used as a proxy for the cost of some GHG emission reductions (those that remain after reductions from the other AB 32 regulatory measures have occurred). By projecting the allowance price through 2020, models estimate the overall cost of a portion of the emissions abatement required under AB 32. Recent analyses suggest that the allowance price in 2020 will likely be near the price floor at the time, around $17 per metric ton.[124]These analyses highlight the uncertainty inherent in the projection of future market conditions, as well as the critical need to identify a "Business as Usual" emissions baseline. While there is much uncertainty in these analyses, the projected allowance prices are lower than the allowance price projected by ARB in the 2010 Updated Economic Analysis to the Scoping Plan.[125] ARB estimated that the 2020 emissions limit could be met with an allowance price of $21 per metric ton and an associated 0.1 to 0.2 percent change in Gross State Product relative to the forecasted 2020 "Business as Usual" baseline.

The similarity of the external estimates of the 2020 allowance price and the projected allowance price in the 2010 Updated Economic Analysis to the Scoping Plan may offer evidence that the assessment of the projected economic impacts of AB 32 is reasonable and that California can reach the near-term 2020 emissions limit without sacrificing economic stability.

The assessment of economic impacts will continue as California develops a climate mitigation portfolio to achieve its long-term climate change mitigation goals. The assessment of the overall economic impacts of the current suite of AB 32 measures will inform the design of the long-term regulatory portfolio as well as the analysis of its impact. However, extending the time horizon of the assessment of economic impacts will present new challenges. Regulatory and climate uncertainty, as well as the performance and costs of existing AB 32 measures, will need to be incorporated in the estimation of potential economic impacts of the long-term climate change mitigation portfolio.

Isolating the specific macroeconomic effects of AB 32 from other economic volatility will continue to present a significant challenge as California looks to the future and achieving long-term climate goals. Long-term economic shifts will need to be incorporated into the assessment of economic impacts. For example, household energy demand and vehicle miles traveled will be influenced by demographic changes in the California population, changes in land use, and the built environment. These issues are the direct focus of regional planning agencies and sustainable community legislation and will require the inclusion of policy interaction and jurisdictional overlap in the long-run modeling of policies affecting energy demand.

Challenges will also arise in estimating the long-term effects of AB 32 across sectors, jurisdictions, and natural resources. The promulgation of climate change mitigation and adaption policies worldwide has highlighted the importance of understanding the far-reaching impacts, both in terms of costs and co-benefits, of climate change and climate change regulations. In 2011, ARB acknowledged the importance of analyzing the impact of the Cap-and-Trade Regulation on localized air quality impacts, special status species, sensitive habitats, and federally protected wetlands in the Adaptive Management Plan. Measuring the long-term impacts of AB 32 will require new methodologies to parse the impacts of individual climate mitigation polices across sectors, jurisdictions, and natural resources. Accounting for the co-benefits and the economic costs of AB 32 will allow California to maximize emission reduction towards long-term climate change mitigation targets while also maximizing the benefits, through improved air quality and natural resources for all Californians.

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124 In $US 2013 (the price floor is currently at $11.34 and rises five percent plus inflation each year). See, for example, the MSG report linking in footnote 105.

125 The projected allowance price of $21/ton ($US 2007) corresponds to -0.2 percent change in gross state product in 2020. Available at *www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf*.

ARB will continue to consult with external experts to develop new analytical tools and methods to incorporate these issues in the assessment of economy-wide and distributional impacts of California's long-term climate change mitigation portfolio.

B. Climate Change and Public Health Assessment

Climate change has been identified as the greatest health threat of the twenty-first century.[126] As described in Chapter II, in California, climate change is expected to increase temperatures, change precipitation patterns, increase the frequency and severity of extreme weather events, and increase wildfires and sea level rise—all of which could have significant impacts on the health of California's residents.

Efforts to reduce GHGs minimize the impacts that climate change will have on human health. In addition to combatting climate change and its subsequent health impacts, many of these efforts have additional direct and indirect public health impacts. It is challenging to assess the magnitude of health impacts that result specifically from AB 32 mitigation measures. However, assessing the directionality of the relationship between many mitigation actions and health based on current empirical literature indicates that overall, the State's climate control program has many health co-benefits, particularly for chronic diseases. In the instances in which mitigation measures may be at odds with positive health outcomes, California must ensure that positive health outcomes are maximized as we address climate change. Local governments, and in particular local public health departments, are important partners in this work.

Assessing the Health Impacts of AB 32 Implementation

As with economic impacts, efforts to fully quantify the health impacts due to Scoping Plan measures remain challenging and are complicated by many factors. Communities and individuals are influenced by a multitude of factors, including socioeconomic conditions, occupational and environmental exposures, the natural and built environments, and personal choices. The influence of all these factors impairs the ability to assign causation between a discrete set of policies, such as the State's climate program, and quantified health impacts. In addition, the long time scale over which certain health impacts may appear—particularly for chronic diseases—complicate attribution to specific actions. Efforts to quantify health impacts by modeling the reduction of co-pollutants to estimate health impacts associated with reductions of GHG measures are difficult because they rely on assumptions about what would have happened if those measures had not been implemented. Assessing the magnitude of health impacts that result specifically from AB 32 mitigation measures remains challenging; however, the directionality of the relationship between many mitigation actions and health can be evaluated using current empirical literature. Efforts are now under way to develop health co-benefit modeling tools to be used in conjunction with regional transportation demand models used by California's Metropolitan Transportation Organizations to help quantify health co-benefits of active transport in future Sustainable Community Strategies (Table 10). For instance, the Strategic Growth Council has convened a Technical Advisory Committee to provide recommendations on the development and use of a health module as part of the Urban Footprint model—a scenario development and modeling tool designed to inform planners on the impacts of development decisions. In addition, CDPH has advanced a model—the Integrated Transport and Health Impact Modeling tool (ITHIM)—that quantifies the health impacts of active transportation and low carbon driving scenarios. The ITHIM model is currently being evaluated by MPOs for use in their regional planning processes.

126 Costello, A., et al. 2009. "Managing the health effects of climate change." The Lancet 373: May 16, 2009. *www.ucl.ac.uk/global-health/project-pages/lancet1/ucl-lancet-climate-change.pdf*.

Table 10: Current Models Designed to Quantify Health Co-Benefits of Sustainable Community Strategies

Model	Timeline
Urban Footprint	SGC Advisory Committee recommendations anticipated Spring 2015
Integrated Transport and Health Impact Modeling Tool (ITHIM model)	Under evaluation by MPOs

Health Impacts of Unmitigated Climate Change

Left unchecked, climate change will affect health in a number of ways. Increasing temperatures from climate change will increase the severity and frequency of heat waves. As California saw in the 2006 heat wave, which resulted in over 650 excess deaths, over 16,000 excess emergency department visits and almost 1,200 excess hospitalizations,[127, 128] extreme heat events create a significant risk of adverse health effects and heat-related mortality. Older adults with chronic health problems, and agriculture, construction, and other outdoors workers are particularly at high risk for adverse effects of extreme heat. Increasing temperatures may exacerbate air pollution in California; in particular, ozone and fine particulate matter.[129] In addition to increasing air pollutants directly, higher temperatures will also likely increase and intensify wildfires in the State, exacerbating poor regional air quality.[130] An increase in air pollution can increase the number of cases of exacerbation of asthma, allergies, and cardiovascular and respiratory diseases, as well as incidents of cancer, neurological and reproductive disorders, and premature death.[131] These impacts are especially felt among our most vulnerable populations, including children, elderly, people with cardiovascular or respiratory diseases, low-income communities, and people without access to health insurance.[132] Changes in climate can also affect the prevalence and geographic location of food-, mosquito-, and vector-borne diseases. While hard to predict, it is possible for infectious diseases like West Nile Virus and Lyme disease to become more prevalent in California as the climate changes.[133] Extreme weather events can lead to both physical and mental health problems.[134] In addition, climate change is associated with higher pollen levels, which contribute to allergies and asthma attacks.[135] Additional climate change impacts, including changes in precipitation patterns, can threaten the quality and supply of water, endanger agriculture production, and lead to many other health-impacting consequences.

The impacts of climate change will not affect everyone the same way. Climate change is expected to more seriously affect the health and well-being of the communities in our society that are the least able to prepare for, cope with, and recover from its impacts. For instance, low-income communities and communities of color are expected to be hit harder by extreme heat, extreme weather events, and worsened air pollution; and are more sensitive to the economic stresses associated with climate change, like increased prices for basic needs and threat of job loss in the agricultural and tourism sectors.[136] If this "climate gap" is not addressed, climate change will exacerbate many of the health and social disparities among California residents. Fortunately,

127 Hoshiko, S., P. English, D. Smith, and R. Trent. 2010. "A simple method for estimating excess mortality due to heat waves, as applied to the 2006 California heat wave." Int J Public Health 55(2): 133–7.
128 Knowlton, K., M. Rotkin-Ellman, G. King, et al. 2009. "The 2006 California heat wave: Impacts on hospitalizations and emergency department visits." Environ Health Perspect 117(1): 61–7.
129 Drechsler, D. M. 2009. Climate Change and Public Health in California.
130 Ibid.
131 CARB. ARB Fact Sheet: Air Pollution and Health. *www.arb.ca.gov/research/health/fs/fs1/fs1.htm*.
132 Shonkoff, S., R. Morello-Frosch, M. Pastor, and J. Sadd. 2009. Environmental health and equity impacts from climate change and mitigation policies in California: A review of the literature. California Climate Change Center. *www.energy.ca.gov/2009publications/CEC-500-2009-038/CEC-500-2009-038-D.PDF*.
133 Drechsler, D. M., N. Motallebi, M. Kleeman, D. Cayan, K. Hayhoe, L. S. Kalkstein, N. Miller, S. Sheridan, J. Jin, and R. A. VanCuren. 2005. Public health-related impacts of climate change in California.
134 CDC. 2013. CDC's Climate Change and Health Program: *www.cdc.gov/nceh/information/climate_and_health.htm*.
135 Ibid.
136 Ibid.

many of the actions that reduce GHG emissions also improve the health and well-being of these vulnerable communities, providing an opportunity to address many of our current environmental and health disparities.

Health Impacts of AB 32 Mitigation Measures

Climate change mitigation efforts not only help combat the direct adverse health impacts of climate change, many of the strategies laid out in the Scoping Plan have additional health co-benefits—many of which can improve existing health disparities. In addition, these climate strategies have implications for chronic disease—which accounts for the vast majority of ill health in California. Chronic disease and injury account for 80 percent of deaths in California, and affect the lives of millions of Californians. Chronic disease is also the key driver of health inequities, lost workforce productivity, and rising health care costs.[137]

The strategies California has employed to reduce GHG emissions from the transportation sector include cleaner and more fuel-efficient vehicles and land use strategies that reduce vehicle miles traveled and promote active transport (bicycling and walking—alone and in combination with public transit.) Putting cleaner and more fuel-efficient vehicles and heavy-duty trucks on the road is reducing GHGs and criteria air pollutants and toxics, including NO_x (which forms ozone and $PM_{2.5}$) and directly emitted $PM_{2.5}$ (which includes toxic diesel PM). Since statewide monitoring efforts began in 2000, $PM_{2.5}$ levels have decreased by an average of four percent each year.[138] Strategies that will help us achieve our 2050 climate goals, including zero emission vehicles and increased electrification of goods movement, will further reduce air pollutants and bring health co-benefits throughout the State. These improvements will particularly benefit many low-income communities of color, who are disproportionately exposed to traffic-related air pollutants.[139]

The impact that our built environment—including land use decisions, transportation systems, and our buildings—has on human health and well-being has long been recognized.[140] Statewide efforts to reduce GHG emissions through integrated land use and transportation planning will fundamentally change our communities, bringing with it public health benefits. The Sustainable Community Strategies (SCSs) adopted by Metropolitan Planning Organizations are planning for communities in a way that reduces travel demand per person, provides greater mobility options, increases access to employment and services, and creates more vibrant surroundings. Reducing vehicle travel will reduce GHG emissions and improve regional air quality. For instance, Southern California's 2012–2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) is expected to result in a 24 percent reduction in total pollution-related health incidences, saving over $1.5 billion per year in total costs.[141] In an effort to improve mobility options for California residents, the RTP/SCSs are also increasing opportunities for residents to use bicycling and walking as travel alternatives. Active transportation increases physical fitness and improves mental health.[142, 143] The health benefits of physical activity are extensive and well documented: physical activity—even in modest amounts—has been linked with a decreased risk of cardiorespiratory diseases, type 2 diabetes, breast and colon cancer, depression, cognitive

137 CDPH. 2013. The Burden of Chronic Disease and Injury. *www.cdph.ca.gov/programs/Documents/BurdenReportOnline%2004-04-13.pdf*.

138 ARB staff analysis.

139 Shonkoff, S., R. Morello-Frosch, M. Pastor, and J. Sadd. 2009. Environmental health and equity impacts from climate change and mitigation policies in California: A review of the literature. California Climate Change Center. *www.energy.ca.gov/2009publications/CEC-500-2009-038/CEC-500-2009-038-D.PDF*.

140 U.S. EPA. 2013. Our Built and Natural Environments. A Technical Review of the Interactions Among Land Use, Transportation, and Environmental Quality. Second Edition, *www.epa.gov/smartgrowth/pdf/b-and-n/b-and-n-EPA-231K13001.pdf*.

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decline, all-cause mortality, and improved musculoskeletal health.[144] These regional plans are not just providing more travel options, they also have implications for other health-related factors, like improved access to health services and employment opportunities and safer, more cohesive neighborhoods. The SCS plans created by regions are key mechanisms for improving factors that have indirect but broad implications for the health and well-being of California's communities.

Climate change strategies that also reduce urban heat islands improve public health and help build climate change resiliency. Increasing urban tree canopy and green space combats climate change directly through sequestration of GHGs and indirectly by reducing ambient air temperatures[145] and reducing the energy needed to heat and cool buildings.[146] The cooling effects of urban trees reduce urban heat islands and can lessen the severity of extreme heat events. Additional health-related benefits of urban trees include reduced air pollutants,[147] reduced noise from traffic,[148] and other psychological and social benefits that help decrease stress and aggressive behavior.[149, 150, 151] Cool roofs and cool pavements also combat climate change while cooling our communities.[152]

Strategies to build more energy-efficient, green buildings—if done right—also can have public health benefits. Improving indoor air quality through source reduction and strategies such as high-efficiency air filtration can greatly improve indoor air quality and occupant health. The State's green building code (CALGreen) includes both required and voluntary measures that improve public health. A number of these measures help assure healthful indoor air quality, such as those addressing chemical emissions from composite wood products, carpets, resilient flooring materials, paints, adhesives, sealants, and insulation, as well as those addressing ventilation. ARB has been active in improving building indoor air quality by sponsoring and conducting research, regulating indoor air cleaners and consumer products, and helping to develop green building standards and guidelines that both reduce GHG emissions and protect indoor air quality.

Reducing the use of nitrogen fertilizers can reduce GHG emissions and improve water quality. Many Californians live in agricultural areas that have water nitrogen levels well above national health-based standards.[153] Central Valley residents in areas with contaminated drinking water must also spend far more than average to purchase safe water, reducing the ability to spend on other health-protective necessities such as food and housing.[154]

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Ongoing Evaluation

As California looks beyond 2020, there will be many opportunities to address long-standing air quality and public health issues through the implementation of sustainable community strategies, the expanded deployment of zero and near-zero emission vehicles in the light- and heavy-duty sectors, and the more efficient use of electricity and natural gas. But we must be mindful of how current and future strategies are implemented, so that they maximize the health benefits while minimizing unintended negative health impacts. For instance, pursuing more compact, transit-oriented development will help reduce GHG emissions and regional air pollutants; however, without appropriate preventative measures, it may have the potential to displace current residents who are disproportionately from low-income and minority communities, as well as to increase near-roadway exposure for some individuals. Additional efforts are needed to prevent any adverse health impacts that may be exacerbated by future land use and transportation decisions. ARB is pursuing research to help improve health impacts from near-roadway exposure.

While the Cap-and-Trade Regulation is designed to reduce GHG emissions, co-benefits such as reductions in criteria and toxic air pollutants, are expected to follow. However, concerns have been raised that these reductions in criteria and toxic air pollutants may not occur in some areas, or that the Cap and Trade Program may exacerbate some localized air pollution impacts. To address these concerns, ARB is working with CAPCOA to design elements of a Cap-and-Trade adaptive management process to identify and respond to concerns about the potential for localized emission increases due to the Cap-and-Trade Regulation. The effort will involve a transparent process to collect, review, and evaluate data to determine if any potential adverse localized air quality impacts might have occurred as a result of implementing Cap-and Trade. If a potential impact is identified through this process, ARB is committed to developing appropriate responses through a public process, including consideration and approval by the Board as necessary.

Despite the difficulties in quantifying the health impacts that result from AB 32 implementation, additional action can be taken to better understand the relationship between climate control measures and health impacts. Several efforts undertaken by the California Department of Public Health will aid in this endeavor, including the development of land use/transportation health impact assessment tools and the development of health community data and indicators to facilitate monitoring and tracking of progress. Additional effort will be needed to advance the development and adoption of tools to evaluate the health benefits of land use and transportation planning, as well as to better educate policymakers, local officials, and the public of these impacts. Moving forward, ARB will continue to monitor and track statewide air pollution levels and community pollutant levels to ensure that our policies and programs continue to improve air quality for all Californians. In addition, ARB will continue to ensure that efforts to reduce GHG emissions through the building sector continue to simultaneously improve indoor air quality and occupant health and safety. Continued research and analysis is needed on the short- and long-term health co-benefits of climate strategies to help communities maximize the positive impacts of local actions.

Federal air quality requirements could be an important driver in influencing how and when California achieves mid-term climate targets. The South Coast and San Joaquin Valley Air Quality Management Districts, together home to more than half of the State's population, must reduce emissions of smog-forming pollutants by about 90 percent below 2010 levels by 2032 to meet the National Ambient Air Quality Standards. Since many of the technologies to reduce smog-forming pollution are the same as those to reduce GHG emissions, and recognizing that it is imperative to integrate planning to meet multiple objectives, complying with federal air quality standards will likely accelerate climate action in California.

In addition, ARB will continue to evaluate ways to monitor the public health of disadvantaged communities. As with economic impacts, communities and individuals are subjected to a multitude of factors that affect their health; consequently, teasing out the impacts of one discrete set of policies, such as the climate program, is very challenging.

C. Environmental Justice and Disadvantaged Communities

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. ARB is committed to considering environmental justice in every program and process.

In 2001, ARB adopted Policies and Actions for Environmental Justice (Policies) to provide a framework for incorporating environmental justice into its programs. The Policies apply to all communities in California, but recognize that environmental justice issues have been raised mostly in the context of low-income and minority communities. These Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of ARB activities. The Policies recognize the need to engage community members as ARB develops and implements its programs. ARB is committed to work closely with all stakeholders, environmental and public health organizations, industry, business owners, other State and local agencies, and all other interested parties, to successfully implement these Policies.

Climate change will present additional challenges to those that environmental justice communities are already facing. Climate change has both direct and indirect impacts on health. These health effects disproportionately impact vulnerable individuals—the young, elderly, and people with chronic illness—and people in environmental justice communities.

Climate change will affect human health, infrastructure, and transportation systems, as well as energy, food, and water supplies. Environmental justice communities may face greater challenges to adapting to climate change due to limited resources. To the extent feasible, the State should work to identify and address any adverse effects of the State's climate programs, policies, and activities on environmental justice communities. In addition, the State must ensure that its climate programs, policies and actions also result in benefits to environmental justice communities.

Potential Impacts and Benefits to Environmental Justice Communities

The implementation of air pollution control programs in California at the federal, State, and local levels targeting GHGs, criteria pollutants, and air toxics will together result in a reduction of air pollution throughout the State. These statewide emission reductions are intended to improve the health of all of California's residents. Specifically, the implementation of the Scoping Plan will result in significant GHG emission reductions in California, accompanied by criteria and toxic pollutant emission reductions at the State and local level. ARB will work to ensure that implementation of the Scoping Plan and all of its programs do not adversely affect environmental justice communities. ARB will continue to work closely with the local air districts to monitor air pollution to ensure that emission reductions at the State, local, and regional levels are occurring as intended, and that environmental justice communities are also sharing in the benefits of cleaner air.

In addition, as part of a focused effort, ARB will continue to work with CAPCOA to design elements of a Cap-and-Trade adaptive management process to identify and respond to concerns about the potential for localized emission increases due to the Cap-and-Trade Regulation. The effort will involve a transparent process to collect, review, and evaluate data to determine if any potential adverse localized air quality impacts might have occurred as result of implementing Cap-and-Trade. If a potential impact is identified through the process, ARB is committed to developing appropriate responses through a public process, including consideration and approval by the Board as necessary.

Environmental justice communities will also benefit directly from the expenditure of Cap-and-Trade auction proceeds. SB 535 requires CalEPA to identify disadvantaged communities based on geographic, socioeconomic, public health, and environmental hazard criteria for purposes of

expending Cap-and-Trade auction proceeds. SB 535 also requires that at least 25 percent of Cap-and-Trade auction proceeds be allocated to projects that benefit these communities, and at least ten percent of the proceeds be allocated to projects located in the communities.

To the extent feasible, all State, regional, and local government agencies with a role in implementing AB 32 should employ available data sources to help target resources, programs, incentives, and enforcement efforts to ensure that residents of EJ communities receive benefits from climate-related efforts and to guard against worsening conditions or creating new environmental justice problems.

Assessing the Effects of AB 32 Climate Change Programs in Environmental Justice Communities

ARB, in coordination with CalEPA and the Office of Environmental Health Hazard Assessment (OEHHA), is working on developing a method to assess the effects of California's climate change mitigation efforts on environmental justice communities. AB 32 requires that, to a feasible extent, ARB must ensure that activities undertaken to address climate change do not disproportionately impact disadvantaged communities and that those communities also benefit from statewide efforts to reduce GHG emissions.

The Environmental Justice Advisory Committee, formed pursuant to AB 32, has expressed significant interest in the development of metrics for tracking, assessing, and quantifying the potential impacts and benefits of the State's climate programs, policies, and actions on California's economy, environment, and public health, particularly with respect to environmental justice communities.

Tools such as CalEnviroScreen (released by CalEPA and OEHHA) have been developed to evaluate multiple indicators of environmental and socioeconomic vulnerability in disadvantaged communities. These tools do not show the impacts of any single program, but are intended to evaluate a community's vulnerability to pollution's adverse effects.

In contrast, the effort discussed here attempts to focus on the impacts of AB 32 programs that reduce GHGs and other climate change pollutants. Any effort to track the effects of AB 32 will require, at a minimum, the identification of indicators that could be tied to the programs of interest and a method for assessing those indicators. An effective and meaningful evaluation of AB 32 programs must rely on indicators expected to fluctuate with government, community, and industry actions to implement climate change mitigation programs.

Project Concept

ARB staff, in coordination with CalEPA, OEHHA and other agencies, is undertaking an effort to assess the effects (benefits and potential impacts) of AB 32 programs on disadvantaged communities. The key objective is to develop a quantitative mechanism to gauge the effectiveness of AB 32 programs with respect to disadvantaged communities. Specifically, to help address the question "Is the implementation of AB 32 programs fulfilling the statutory responsibility to provide benefits and avoid disproportionate harmful impacts to the extent feasible in those communities?"

ARB is developing a multi-phase approach, beginning with identifying sources of existing available and accessible data. This first phase would look at changes in emissions of multiple air pollutants at individual facilities and include a visual tool to support ready public access to those data. ARB will rely on a process of extracting and reviewing criteria and toxics emissions information, developed by and in concert with the local air districts, in order to understand localized impacts. The next phase would expand in scope to encompass entire disadvantaged communities (per SB 535), reflecting emissions from both facilities and mobile sources in

each area. In a later phase, we would include relevant emission reduction and economic data from projects funded through the investment of Cap-and-Trade auction proceeds to benefit disadvantaged communities. Table 11 below describes the phases of the proposed approach. The Scoping Plan Economic Advisors, other State agencies (like OEHHA), and local air districts may aid ARB by supplementing these data and analyses, which would provide an expanded view.

Existing data sources include the following:

- California Electronic Greenhouse Gas Reporting Tool (Cal e-GGRT)
  - Cal e-GGRT is California's Mandatory Greenhouse Gas Emissions Reporting Program that provides quality assured and third-party verified emissions data from sources that contribute the most to Statewide GHG emissions.
- California Emission Inventory Development and Reporting System (CEIDARS)
  - CEIDARS data are the result of facility reports to air districts that are passed to ARB. CEIDARS provides facility criteria and toxic emissions data.
- EMissions FACtors for emissions from California's on-road vehicles (EMFAC)
  - EMFAC is California's model for estimating GHG, criteria and toxic emissions from on-road vehicles operating in California.
- Off-Road Motor Vehicles and Equipment
  - Category-specific methods and inventory models are being developed for specific regulatory support projects to replace the OFFROAD model. The following ARB website lists the categories that have been or are being updated with new methods and data: *www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles*.

The goal is to provide an evaluation of the effects of AB 32 programs, considering multiple variables, including greenhouse gases, criteria pollutants, and toxic air contaminants. This assessment would not only meet the goals of the Cap-and-Trade Adaptive Management Plan but would also include impacts not otherwise attributed to Cap-and Trade. The results of this assessment would provide an evaluation of the effects of all AB 32 programs on disadvantaged communities. Data collected could provide information needed for ARB to plan and implement investment, regulatory, or policy responses to any identified adverse localized impacts on specific disadvantaged communities.

Staff intends to present this effort as part of the Cap-and-Trade Adaptive Management Plan public workshops scheduled for mid-2014. Additionally, staff anticipates that with the Cap-and-Trade Adaptive Management Plan, an update on the progress of this effort will be presented to the Board before the end of 2014.

Table 11: Project Phases for Assessing the Effects of AB 32 Programs on Disadvantaged Communities

Phase	Description
Phase 1 Collect and Make Available Facility Data	The focus will be on facilities that are required to report consistent with ARB's Mandatory Reporting Regulation. We will compile several years of climate, criteria pollutant, and air toxics emissions data for these facilities. We will also make this information available for review and analysis by the public, including communities, academics, and government.
Phase 2 Evaluate Facility Emissions Data	Analyze the information collected in Phase 1. We intend to utilize the data evaluation process developed for the Cap-and-Trade Adaptive Management Plan and annually provide a summary of findings for public review.
Phase 3 Collect and Make Available Community Data	The focus will be on disadvantaged communities as defined by CalEPA under SB 535. We will integrate "community-level" mobile source emission data and investment data from Cap-and-Trade auction proceeds. In this phase, we will also quantify trends and provide data biennially for public review and analysis.
Phase 4 Evaluate Community Data	Conduct a detailed analysis of the information collected in Phase 3. We will summarize our findings and biennially release results for public review.
Phase 5 Respond to Evaluations in Scoping Plan	Respond to Phase 4 results and discuss project progress in the next Update to the Climate Change Scoping Plan.

Outreach and Community Capacity Building

As climate policy and programs are developed and implemented, community capacity building through education and outreach efforts—as well as integration of community members into the decision making process—are critical components of helping to ensure that the needs of these communities are known and addressed. Additional effort is needed in communities that are geographically, linguistically, and/or economically isolated. Collaboration with trusted sources of information, such as community-based organizations, regional climate collaboratives, and culturally appropriate messaging techniques, are recommended.

Environmental Justice Advisory Committee

To ensure environmental justice needs and concerns are integrated into the State's climate programs, ARB reconvened the Environmental Justice Advisory Committee (Committee) to advise the Board on the Update. On March 21, 2013, the Board appointed members based on nominations received from environmental justice organizations and community groups.

Environmental Justice Advisory Committee		
Martha Dina Argüello	Physicians for Social Responsibility	Los Angeles
Nicole Capretz *(Served on EJAC until August 2013)*	Environmental Health Coalition	San Diego
Gisele Fong	End Oil	Los Angeles
Tom Frantz	Association of Irritated Residents	Central Valley
Kevin Hamilton	Clinica Sierra Vista	Central Valley
Rey León	Valley LEAP	Central Valley
Penny Newman *(Appointed to EJAC but unable to serve)*	Center for Community Action and Environmental Justice	Inland Empire
Luis Olmedo	Comite Civico Del Valley	Imperial Valley
Susan Riggs *(Served on EJAC until March 2014)*	San Diego Housing Federation	San Diego
Kemba Shakur	Urban Releaf	Bay Area
Mari Rose Taruc	Asian Pacific Environmental Network	Bay Area
Monica Wilson	Global Alliance for Incinerator Alternatives	Bay Area
Ryan Briscoe Young *(Served on EJAC until April 2014)*	The Greenlining Institute	Statewide

The Committee met four times from June 2013 to April 2014 to discuss the Update. The Committee focused their discussions on each Scoping Plan sector and developed comprehensive recommendations that ARB considered in drafting this Update. The Committee's "Final Recommendations on the Proposed AB 32 Scoping Plan" provided recommendations for each Scoping Plan sector and overarching environmental justice policy. The final recommendations included the need for monitoring and assessing potential impacts of the State's climate programs; a call for a 2030 target of, at a minimum, 40 percent reduction from 1990 levels and a 2040 target of, at a minimum, 60 percent reduction from 1990 levels; a call for California to reduce its energy use and transition to 100 percent renewable energy; financial support for transportation in disadvantaged communities; and amendments to the Cap-and-Trade Regulation that would exclude direct allocation and offset credits. The Committee's final recommendations can be found in Appendix E.

D. Environmental Analysis

ARB prepared an environmental analysis (EA) of the Scoping Plan Update pursuant to its regulatory program certified by the Secretary of the Natural Resources Agency (14 CCR 15251(d); 17 CCR 60000–60008). The draft EA is included as Appendix F. In accordance with Public Resources Code section 21080.5 of CEQA, public agencies with certified regulatory programs are exempt from certain CEQA requirements, including but not limited to those preparing environmental impact reports, negative declarations, and initial studies (14 CCR 15250). The resource areas from the CEQA Guidelines Environmental Checklist are being used as a framework for assessing the potential for significant impacts (17 CCR 60005(b)).

A draft EA was released for a 45-day public review on March 15, 2014. ARB summarized and responded in writing to all comments submitted on the EA in a supplemental response document for the Board to consider for approval along with the Update.

VII. Conclusions

California is forging a path forward in the fight against climate change. By expanding on existing policies and developing new ones, we are steadily bending the arc of economic growth in our state in a cleaner, more sustainable direction. And while climate change demands it, the steps we are taking to cut emissions are the very actions we should be taking anyway to build for the future in California.

Sustainability and climate action have increasingly become part of the DNA of who we are and how we, as Californians, see ourselves. It is now as inconceivable to pump unlimited amounts of carbon pollution into the atmosphere as it was once to spew mercury, lead, sulfur dioxide, or arsenic into the air.

Day by day, in steady steps of visible progress, we are seeing the emergence of a clean energy future. Solar panels are commonplace, whether on roofs, commercial warehouses, or in shiny ground-based arrays across the State. Thousands of wind turbines have become part of the California clean energy panorama, their blades describing slow graceful arcs as they generate more than 4,000 megawatts of pollution-free energy.

Electric vehicles are a common sight on our streets and highways, and each day brings more charging stations to parking structures and shopping malls. Biofuel is available at retail outlets. Even big-rigs are getting a climate makeover as trailer skirts, low-rolling resistance tires, and aggressively aerodynamic cabs mean less wind resistance, lower fuel costs, and fewer emissions.

These efforts aren't just cutting greenhouse gases. They are cleaning our air; helping to better preserve water, and agricultural lands, and other critical natural resources; powering the growth of new long-term economic drivers in the state; and helping to pull together and better align public policy priorities across programmatic silos.

As California takes these steps, public support for action also continues to grow. Recent polls show that 79 percent of Californians believe global warming is happening, and a majority want to see more action by the State; 73 percent say corporations and industry need to do more; 70 percent feel they, themselves, should be doing more to address the issue.

This public consensus aligns with the dictates of science, which tell us unequivocally that we must continue on the path we are on, and even accelerate our efforts in the coming years.

That is exactly what this Update does. It builds on California's framework for climate action with a range of strategies that will keep pushing our state toward a cleaner, more sustainable future. It is a continuation of what we have already begun. Now is the time to make it a reality.

California Environmental Protection Agency

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Assembly Bill No. 32

CHAPTER 488

An act to add Division 25.5 (commencing with Section 38500) to the Health and Safety Code, relating to air pollution.

[Approved by Governor September 27, 2006. Filed with Secretary of State September 27, 2006.]

LEGISLATIVE COUNSEL'S DIGEST

AB 32, Nunez. Air pollution: greenhouse gases: California Global Warming Solutions Act of 2006.

Under existing law, the State Air Resources Board (state board), the State Energy Resources Conservation and Development Commission (Energy Commission), and the California Climate Action Registry all have responsibilities with respect to the control of emissions of greenhouse gases, as defined, and the Secretary for Environmental Protection is required to coordinate emission reductions of greenhouse gases and climate change activity in state government.

This bill would require the state board to adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program, as specified. The bill would require the state board to adopt a statewide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020, as specified. The bill would require the state board to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions, as specified. The bill would authorize the state board to adopt market-based compliance mechanisms, as defined, meeting specified requirements. The bill would require the state board to monitor compliance with and enforce any rule, regulation, order, emission limitation, emissions reduction measure, or market-based compliance mechanism adopted by the state board, pursuant to specified provisions of existing law. The bill would authorize the state board to adopt a schedule of fees to be paid by regulated sources of greenhouse gas emissions, as specified.

Because the bill would require the state board to establish emissions limits and other requirements, the violation of which would be a crime, this bill would create a state-mandated local program.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

The people of the State of California do enact as follows:

SECTION 1. Division 25.5 (commencing with Section 38500) is added to the Health and Safety Code, to read:

DIVISION 25.5. CALIFORNIA GLOBAL WARMING SOLUTIONS ACT OF 2006

PART 1. GENERAL PROVISIONS

Chapter 1. Title of Division

38500. This division shall be known, and may be cited, as the California Global Warming Solutions Act of 2006.

Chapter 2. Findings and Declarations

38501. The Legislature finds and declares all of the following:

(a) Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.

(b) Global warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing, and forestry. It will also increase the strain on electricity supplies necessary to meet the demand for summer air-conditioning in the hottest parts of the state.

(c) California has long been a national and international leader on energy conservation and environmental stewardship efforts, including the areas of air quality protections, energy efficiency requirements, renewable energy standards, natural resource conservation, and greenhouse gas emission standards for passenger vehicles. The program established by this division will continue this tradition of environmental leadership by placing California at the forefront of national and international efforts to reduce emissions of greenhouse gases.

(d) National and international actions are necessary to fully address the issue of global warming. However, action taken by California to reduce emissions of greenhouse gases will have far-reaching effects by encouraging other states, the federal government, and other countries to act.

(e) By exercising a global leadership role, California will also position its economy, technology centers, financial institutions, and businesses to benefit from national and international efforts to reduce emissions of greenhouse gases. More importantly, investing in the development of innovative and pioneering technologies will assist California in achieving the 2020 statewide limit on emissions of greenhouse gases established by this division and will provide an opportunity for the state to take a global economic and technological leadership role in reducing emissions of greenhouse gases.

(f) It is the intent of the Legislature that the State Air Resources Board coordinate with state agencies, as well as consult with the environmental justice community, industry sectors, business groups, academic institutions, environmental organizations, and other stakeholders in implementing this division.

(g) It is the intent of the Legislature that the State Air Resources Board consult with the Public Utilities Commission in the development of emissions reduction measures, including limits on emissions of greenhouse gases applied to electricity and natural gas providers regulated by the Public Utilities Commission in order to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements.

(h) It is the intent of the Legislature that the State Air Resources Board design emissions reduction measures to meet the statewide emissions limits for greenhouse gases established pursuant to this division in a manner that minimizes costs and maximizes benefits for California's economy, improves and modernizes California's energy infrastructure and maintains electric system reliability, maximizes additional environmental and economic co-benefits for California, and complements the state's efforts to improve air quality.

(i) It is the intent of the Legislature that the Climate Action Team established by the Governor to coordinate the efforts set forth under Executive Order S-3-05 continue its role in coordinating overall climate policy.

Chapter 3. Definitions

38505. For the purposes of this division, the following terms have the following meanings:

(a) "Allowance" means an authorization to emit, during a specified year, up to one ton of carbon dioxide equivalent.

(b) "Alternative compliance mechanism" means an action undertaken by a greenhouse gas emission source that achieves the equivalent reduction of greenhouse gas emissions over the same time period as a direct emission reduction, and that is approved by the state board. "Alternative compliance mechanism" includes, but is not limited to, a

flexible compliance schedule, alternative control technology, a process change, or a product substitution.

(c) "Carbon dioxide equivalent" means the amount of carbon dioxide by weight that would produce the same global warming impact as a given weight of another greenhouse gas, based on the best available science, including from the Intergovernmental Panel on Climate Change.

(d) "Cost-effective" or "cost-effectiveness" means the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential.

(e) "Direct emission reduction" means a greenhouse gas emission reduction action made by a greenhouse gas emission source at that source.

(f) "Emissions reduction measure" means programs, measures, standards, and alternative compliance mechanisms authorized pursuant to this division, applicable to sources or categories of sources, that are designed to reduce emissions of greenhouse gases.

(g) "Greenhouse gas" or "greenhouse gases" includes all of the following gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexaflouride.

(h) "Greenhouse gas emissions limit" means an authorization, during a specified year, to emit up to a level of greenhouse gases specified by the state board, expressed in tons of carbon dioxide equivalents.

(i) "Greenhouse gas emission source" or "source" means any source, or category of sources, of greenhouse gas emissions whose emissions are at a level of significance, as determined by the state board, that its participation in the program established under this division will enable the state board to effectively reduce greenhouse gas emissions and monitor compliance with the statewide greenhouse gas emissions limit.

(j) "Leakage" means a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state.

(k) "Market-based compliance mechanism" means either of the following:

(1) A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases.

(2) Greenhouse gas emissions exchanges, banking, credits, and other transactions, governed by rules and protocols established by the state board, that result in the same greenhouse gas emission reduction, over the same time period, as direct compliance with a greenhouse gas emission limit or emission reduction measure adopted by the state board pursuant to this division.

(*l*) "State board" means the State Air Resources Board.

(m) "Statewide greenhouse gas emissions" means the total annual emissions of greenhouse gases in the state, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in California, accounting for transmission and distribution line losses, whether the electricity is generated in state or imported. Statewide emissions shall be expressed in tons of carbon dioxide equivalents.

(n) "Statewide greenhouse gas emissions limit" or "statewide emissions limit" means the maximum allowable level of statewide greenhouse gas emissions in 2020, as determined by the state board pursuant to Part 3 (commencing with Section 38850).

Chapter 4. Role of State Board

38510. The State Air Resources Board is the state agency charged with monitoring and regulating sources of emissions of greenhouse gases that cause global warming in order to reduce emissions of greenhouse gases.

PART 2. MANDATORY GREENHOUSE GAS EMISSIONS REPORTING

38530. (a) On or before January 1, 2008, the state board shall adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program.

(b) The regulations shall do all of the following:

(1) Require the monitoring and annual reporting of greenhouse gas emissions from greenhouse gas emission sources beginning with the sources or categories of sources that contribute the most to statewide emissions.

(2) Account for greenhouse gas emissions from all electricity consumed in the state, including transmission and distribution line losses from electricity generated within the state or imported from outside the state. This requirement applies to all retail sellers of electricity, including load-serving entities as defined in subdivision (j) of Section 380 of the Public Utilities Code and local publicly owned electric utilities as defined in Section 9604 of the Public Utilities Code.

(3) Where appropriate and to the maximum extent feasible, incorporate the standards and protocols developed by the California Climate Action Registry, established pursuant to Chapter 6 (commencing with Section 42800) of Part 4 of Division 26. Entities that voluntarily participated in the California Climate Action Registry prior to December 31, 2006, and have developed a greenhouse gas emission reporting program, shall not be required to significantly alter their reporting or verification program except as necessary to ensure that reporting is complete and verifiable for the purposes of compliance with this division as determined by the state board.

(4) Ensure rigorous and consistent accounting of emissions, and provide reporting tools and formats to ensure collection of necessary data.

(5) Ensure that greenhouse gas emission sources maintain comprehensive records of all reported greenhouse gas emissions.

(c) The state board shall do both of the following:

(1) Periodically review and update its emission reporting requirements, as necessary.

(2) Review existing and proposed international, federal, and state greenhouse gas emission reporting programs and make reasonable efforts to promote consistency among the programs established pursuant to this part and other programs, and to streamline reporting requirements on greenhouse gas emission sources.

PART 3. STATEWIDE GREENHOUSE GAS EMISSIONS LIMIT

38550. By January 1, 2008, the state board shall, after one or more public workshops, with public notice, and an opportunity for all interested parties to comment, determine what the statewide greenhouse gas emissions level was in 1990, and approve in a public hearing, a statewide greenhouse gas emissions limit that is equivalent to that level, to be achieved by 2020. In order to ensure the most accurate determination feasible, the state board shall evaluate the best available scientific, technological, and economic information on greenhouse gas emissions to determine the 1990 level of greenhouse gas emissions.

38551. (a) The statewide greenhouse gas emissions limit shall remain in effect unless otherwise amended or repealed.

(b) It is the intent of the Legislature that the statewide greenhouse gas emissions limit continue in existence and be used to maintain and continue reductions in emissions of greenhouse gases beyond 2020.

(c) The state board shall make recommendations to the Governor and the Legislature on how to continue reductions of greenhouse gas emissions beyond 2020.

PART 4. GREENHOUSE GAS EMISSIONS REDUCTIONS

38560. The state board shall adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions from sources or categories of sources, subject to the criteria and schedules set forth in this part.

38560.5. (a) On or before June 30, 2007, the state board shall publish and make available to the public a list of discrete early action greenhouse gas emission reduction measures that can be implemented prior to the measures and limits adopted pursuant to Section 38562.

(b) On or before January 1, 2010, the state board shall adopt regulations to implement the measures identified on the list published pursuant to subdivision (a).

(c) The regulations adopted by the state board pursuant to this section shall achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from those sources or categories of

sources, in furtherance of achieving the statewide greenhouse gas emissions limit.

(d) The regulations adopted pursuant to this section shall be enforceable no later than January 1, 2010.

38561. (a) On or before January 1, 2009, the state board shall prepare and approve a scoping plan, as that term is understood by the state board, for achieving the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions from sources or categories of sources of greenhouse gases by 2020 under this division. The state board shall consult with all state agencies with jurisdiction over sources of greenhouse gases, including the Public Utilities Commission and the State Energy Resources Conservation and Development Commission, on all elements of its plan that pertain to energy related matters including, but not limited to, electrical generation, load based-standards or requirements, the provision of reliable and affordable electrical service, petroleum refining, and statewide fuel supplies to ensure the greenhouse gas emissions reduction activities to be adopted and implemented by the state board are complementary, nonduplicative, and can be implemented in an efficient and cost-effective manner.

(b) The plan shall identify and make recommendations on direct emission reduction measures, alternative compliance mechanisms, market-based compliance mechanisms, and potential monetary and nonmonetary incentives for sources and categories of sources that the state board finds are necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of greenhouse gas emissions by 2020.

(c) In making the determinations required by subdivision (b), the state board shall consider all relevant information pertaining to greenhouse gas emissions reduction programs in other states, localities, and nations, including the northeastern states of the United States, Canada, and the European Union.

(d) The state board shall evaluate the total potential costs and total potential economic and noneconomic benefits of the plan for reducing greenhouse gases to California's economy, environment, and public health, using the best available economic models, emission estimation techniques, and other scientific methods.

(e) In developing its plan, the state board shall take into account the relative contribution of each source or source category to statewide greenhouse gas emissions, and the potential for adverse effects on small businesses, and shall recommend a de minimis threshold of greenhouse gas emissions below which emission reduction requirements will not apply.

(f) In developing its plan, the state board shall identify opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, including, but not limited to, carbon sequestration projects and best management practices.

(g) The state board shall conduct a series of public workshops to give interested parties an opportunity to comment on the plan. The state board shall conduct a portion of these workshops in regions of the state that have the most significant exposure to air pollutants, including, but not limited to, communities with minority populations, communities with low-income populations, or both.

(h) The state board shall update its plan for achieving the maximum technologically feasible and cost-effective reductions of greenhouse gas emissions at least once every five years.

38562. (a) On or before January 1, 2011, the state board shall adopt greenhouse gas emission limits and emission reduction measures by regulation to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions in furtherance of achieving the statewide greenhouse gas emissions limit, to become operative beginning on January 1, 2012.

(b) In adopting regulations pursuant to this section and Part 5 (commencing with Section 38570), to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, the state board shall do all of the following:

(1) Design the regulations, including distribution of emissions allowances where appropriate, in a manner that is equitable, seeks to minimize costs and maximize the total benefits to California, and encourages early action to reduce greenhouse gas emissions.

(2) Ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities.

(3) Ensure that entities that have voluntarily reduced their greenhouse gas emissions prior to the implementation of this section receive appropriate credit for early voluntary reductions.

(4) Ensure that activities undertaken pursuant to the regulations complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions.

(5) Consider cost-effectiveness of these regulations.

(6) Consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health.

(7) Minimize the administrative burden of implementing and complying with these regulations.

(8) Minimize leakage.

(9) Consider the significance of the contribution of each source or category of sources to statewide emissions of greenhouse gases.

(c) In furtherance of achieving the statewide greenhouse gas emissions limit, by January 1, 2011, the state board may adopt a regulation that establishes a system of market-based declining annual aggregate emission limits for sources or categories of sources that emit greenhouse gas emissions, applicable from January 1, 2012, to December 31, 2020, inclusive, that the state board determines will achieve the maximum

technologically feasible and cost-effective reductions in greenhouse gas emissions, in the aggregate, from those sources or categories of sources.

(d) Any regulation adopted by the state board pursuant to this part or Part 5 (commencing with Section 38570) shall ensure all of the following:

(1) The greenhouse gas emission reductions achieved are real, permanent, quantifiable, verifiable, and enforceable by the state board.

(2) For regulations pursuant to Part 5 (commencing with Section 38570), the reduction is in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur.

(3) If applicable, the greenhouse gas emission reduction occurs over the same time period and is equivalent in amount to any direct emission reduction required pursuant to this division.

(e) The state board shall rely upon the best available economic and scientific information and its assessment of existing and projected technological capabilities when adopting the regulations required by this section.

(f) The state board shall consult with the Public Utilities Commission in the development of the regulations as they affect electricity and natural gas providers in order to minimize duplicative or inconsistent regulatory requirements.

(g) After January 1, 2011, the state board may revise regulations adopted pursuant to this section and adopt additional regulations to further the provisions of this division.

38563. Nothing in this division restricts the state board from adopting greenhouse gas emission limits or emission reduction measures prior to January 1, 2011, imposing those limits or measures prior to January 1, 2012, or providing early reduction credit where appropriate.

38564. The state board shall consult with other states, and the federal government, and other nations to identify the most effective strategies and methods to reduce greenhouse gases, manage greenhouse gas control programs, and to facilitate the development of integrated and cost-effective regional, national, and international greenhouse gas reduction programs.

38565. The state board shall ensure that the greenhouse gas emission reduction rules, regulations, programs, mechanisms, and incentives under its jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California and provide an opportunity for small businesses, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions.

PART 5. MARKET-BASED COMPLIANCE MECHANISMS

38570. (a) The state board may include in the regulations adopted pursuant to Section 38562 the use of market-based compliance mechanisms to comply with the regulations.

(b) Prior to the inclusion of any market-based compliance mechanism in the regulations, to the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, the state board shall do all of the following:

(1) Consider the potential for direct, indirect, and cumulative emission impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution.

(2) Design any market-based compliance mechanism to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants.

(3) Maximize additional environmental and economic benefits for California, as appropriate.

(c) The state board shall adopt regulations governing how market-based compliance mechanisms may be used by regulated entities subject to greenhouse gas emission limits and mandatory emission reporting requirements to achieve compliance with their greenhouse gas emissions limits.

38571. The state board shall adopt methodologies for the quantification of voluntary greenhouse gas emission reductions. The state board shall adopt regulations to verify and enforce any voluntary greenhouse gas emission reductions that are authorized by the state board for use to comply with greenhouse gas emission limits established by the state board. The adoption of methodologies is exempt from the rulemaking provisions of the Administrative Procedure Act (Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code).

38574. Nothing in this part or Part 4 (commencing with Section 38560) confers any authority on the state board to alter any programs administered by other state agencies for the reduction of greenhouse gas emissions.

PART 6. ENFORCEMENT

38580. (a) The state board shall monitor compliance with and enforce any rule, regulation, order, emission limitation, emissions reduction measure, or market-based compliance mechanism adopted by the state board pursuant to this division.

(b) (1) Any violation of any rule, regulation, order, emission limitation, emissions reduction measure, or other measure adopted by the state board pursuant to this division may be enjoined pursuant to Section 41513, and the violation is subject to those penalties set forth in Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(2) Any violation of any rule, regulation, order, emission limitation, emissions reduction measure, or other measure adopted by the state board pursuant to this division shall be deemed to result in an emission of an air contaminant for the purposes of the penalty provisions of Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(3) The state board may develop a method to convert a violation of any rule, regulation, order, emission limitation, or other emissions reduction measure adopted by the state board pursuant to this division into the number of days in violation, where appropriate, for the purposes of the penalty provisions of Article 3 (commencing with Section 42400) of Chapter 4 of Part 4 of, and Chapter 1.5 (commencing with Section 43025) of Part 5 of, Division 26.

(c) Section 42407 and subdivision (i) of Section 42410 shall not apply to this part.

PART 7. MISCELLANEOUS PROVISIONS

38590. If the regulations adopted pursuant to Section 43018.5 do not remain in effect, the state board shall implement alternative regulations to control mobile sources of greenhouse gas emissions to achieve equivalent or greater reductions.

38591. (a) The state board, by July 1, 2007, shall convene an environmental justice advisory committee, of at least three members, to advise it in developing the scoping plan pursuant to Section 38561 and any other pertinent matter in implementing this division. The advisory committee shall be comprised of representatives from communities in the state with the most significant exposure to air pollution, including, but not limited to, communities with minority populations or low-income populations, or both.

(b) The state board shall appoint the advisory committee members from nominations received from environmental justice organizations and community groups.

(c) The state board shall provide reasonable per diem for attendance at advisory committee meetings by advisory committee members from nonprofit organizations.

(d) The state board shall appoint an Economic and Technology Advancement Advisory Committee to advise the state board on activities that will facilitate investment in and implementation of technological research and development opportunities, including, but not limited to, identifying new technologies, research, demonstration projects, funding opportunities, developing state, national, and international partnerships and technology transfer opportunities, and identifying and assessing research and advanced technology investment and incentive opportunities that will assist in the reduction of greenhouse gas emissions. The committee may also advise the state board on state, regional, national, and

international economic and technological developments related to greenhouse gas emission reductions.

38592. (a) All state agencies shall consider and implement strategies to reduce their greenhouse gas emissions.

(b) Nothing in this division shall relieve any person, entity, or public agency of compliance with other applicable federal, state, or local laws or regulations, including state air and water quality requirements, and other requirements for protecting public health or the environment.

38593. (a) Nothing in this division affects the authority of the Public Utilities Commission.

(b) Nothing in this division affects the obligation of an electrical corporation to provide customers with safe and reliable electric service.

38594. Nothing in this division shall limit or expand the existing authority of any district, as defined in Section 39025.

38595. Nothing in this division shall preclude, prohibit, or restrict the construction of any new facility or the expansion of an existing facility subject to regulation under this division, if all applicable requirements are met and the facility is in compliance with regulations adopted pursuant to this division.

38596. The provisions of this division are severable. If any provision of this division or its application is held invalid, that invalidity shall not affect other provisions or applications that can be given effect without the invalid provision or application.

38597. The state board may adopt by regulation, after a public workshop, a schedule of fees to be paid by the sources of greenhouse gas emissions regulated pursuant to this division, consistent with Section 57001. The revenues collected pursuant to this section, shall be deposited into the Air Pollution Control Fund and are available upon appropriation, by the Legislature, for purposes of carrying out this division.

38598. (a) Nothing in this division shall limit the existing authority of a state entity to adopt and implement greenhouse gas emissions reduction measures.

(b) Nothing in this division shall relieve any state entity of its legal obligations to comply with existing law or regulation.

38599. (a) In the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm, the Governor may adjust the applicable deadlines for individual regulations, or for the state in the aggregate, to the earliest feasible date after that deadline.

(b) The adjustment period may not exceed one year unless the Governor makes an additional adjustment pursuant to subdivision (a).

(c) Nothing in this section affects the powers and duties established in the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code).

(d) The Governor shall, within 10 days of invoking subdivision (a), provide written notification to the Legislature of the action undertaken.

SEC. 2 No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because the only costs that

may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, eliminates a crime or infraction, or changes the penalty for a crime or infraction, within the meaning of Section 17556 of the Government Code, or changes the definition of a crime within the meaning of Section 6 of Article XIII B of the California Constitution.

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Appendix B
Status of Initial Scoping Plan Measures

The initial Scoping Plan recommended specific GHG emission reduction measures in California's major economic sectors: Transportation; Electricity and Natural Gas; Water; Green Buildings; Industry; Recycling and Waste Management; Forest; High Global Warming Potential Gases; and Agriculture. This Appendix describes the implementation status of these measures. The measures are presented according to the sectors and the numbering convention used in the initial Scoping Plan. Each sector contains a summary table of the measures' statuses followed by more detailed updates. The Cap-and-Trade Regulation affects stationary sources and natural gas and fuel suppliers across various economic sectors and implementation efforts are briefly discussed upfront in this Appendix.

A. Cap-and-Trade Regulation

The AB 32 Scoping Plan recommended the development of a California Cap-and-Trade Program that links with other Western Climate Initiative partner programs to create a regional market system. In 2011, the Cap-and-Trade Regulation was approved by the Air Resources Board (ARB or Board), and on January 1, 2012, California successfully launched the most comprehensive greenhouse gas Cap-and-Trade Program in the world. Starting on January 1, 2013, the largest greenhouse gas emitters have compliance obligations for their emissions. As the emissions cap is gradually reduced over time, and as additional sources are brought under the cap to include the vast majority of emissions in the State, the program will ensure that California remains on track to continually reduce emissions and meet the 2020 limit. On January 1, 2015, the program will expand to include transportation and natural gas fuel suppliers. Looking out into the future, the Cap-and-Trade Program will play a critical role in keeping California on the right emissions reduction trajectory to meet ongoing reduction targets at the lowest possible cost. The program is also sending a clear signal that investment in clean, low carbon technologies will pay off.

On January 1, 2014, California linked its Cap-and-Trade Program with Québec's. By successfully linking cap-and-trade programs across jurisdictions and increasing opportunities for emission reductions, this linkage represents another important step in California's efforts to collaborate with other partners around the globe to address climate change.

ARB has held six successful auctions to date. More detailed information on the Cap-and-Trade Program can be found on the ARB webpage at: http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm

B. Transportation Sector

The status of each transportation measure in the initial Scoping Plan is summarized in Table 1 below.

Table 1: Status of Transportation Measures

Transportation Measures		**Status of Measure/Board Consideration Dates**
T-1	Advanced Clean Cars	January 2012
T-2	Low Carbon Fuel Standard	April 2009 (early action item)
T-3	Regional Transportation-Related Greenhouse Gas Targets	Targets Approved September 2010. Seven regions, including the four major urban regions, have adopted Sustainable Communities Strategies (SCSs) that meet, and in some cases exceed, the targets.
T-4	Vehicle Efficiency Measures 1. Tire Pressure 2. Fuel Efficiency Tire Program 3. Low Friction Oil 4. Solar Reflective Automotive Paint and Window Glazing	 March 2009 (early action items) Under consideration by United States Department of Transportation Part of Advanced Clean Cars program Part of Advanced Clean Cars program
T-5	Ship Electrification at Ports (Shore Power)	December 2007 (early action item)
T-6	Goods Movement Efficiency Measures 1. Port Drayage Trucks ---------- 2. Transportation Refrigeration Units Cold Storage Prohibition 3. Cargo Handling Equipment, Anti-Idling, Hybrid, Electrification 4. Goods Movement Systemwide Efficiency Improvements 5. Commercial Harbor Craft Maintenance and Design Efficiency 6. Clean Ships 7. Vessel Speed Reduction	 December 2007 (early action item) ---------- Sub-measures 2–7 and others are being considered in the development of the 2014 Sustainable Freight Strategy
T-7	Heavy-Duty Vehicle GHG Emission Reduction • Tractor-Trailer GHG Regulation • Heavy Duty Greenhouse Gas Standards for New Vehicle and Engines (Phase I)	 December 2008 (early action item) December 2013
T-8	Medium- and Heavy-Duty Vehicle Hybridization Voucher Incentive Project	April 2009 (early action item)
T-9	High-Speed Rail	Construction contract awarded August 2013

Transportation Sector - Measures Identified in Scoping Plan

T-1: Advanced Clean Cars Program

Background

The Board approved the Advanced Clean Cars (ACC) program in January 2012. The ACC program closely aligns the Low Emission Vehicle, Zero Emission Vehicle (ZEV), and greenhouse gas light duty vehicle standards to lay the foundation for the next generation of ultra-clean vehicles. The Program includes more stringent GHG emission standards, tighter criteria pollutant standards, and increased ZEV production requirements from 2017-2025 in passenger cars and trucks.

ARB's Advanced Clean Cars program, developed in part through collaboration with the United States Environmental Protection Agency (U.S. EPA) and the National Highway Traffic Safety Administration (NHTSA) will cut GHG emissions from new passenger vehicles in 2025 by half, compared to today's fleet mix.

The ACC program also includes an updated Zero Emission Vehicle rule, which requires plug-in electric or hydrogen fuel cell vehicles to account for about 15 percent of new vehicle sales in California by 2025.

Executive Order (EO) B-16-12, issued by Governor Brown in 2012, established a 2050 GHG reduction target for the transportation sector of 80 percent from 1990 levels. The EO called for 1.5 million zero emission vehicles on California's roadways by 2025, along with zero emission vehicle purchasing requirements for State government fleets.

Status

In October 2012, U.S. EPA finalized similar GHG emission standards while NHTSA finalized similar fuel economy standards. Subsequently, in November 2012 the Board approved amendments to the Advanced Clean Cars regulations that allowed vehicle manufacturers to demonstrate compliance with ARB regulations based on compliance with the federal standards, providing a path for vehicle manufacturers to meet a single set of national GHG emission standards through the 2025 model year.
On December 27, 2012, U.S. EPA approved ARB's request for a waiver under the Clean Air Act, giving California the green light on its Advanced Clean Cars package of regulations.

In 2013, the Governor's Office released the ZEV Action Plan identifying specific strategies and actions that State agencies will take to meet milestones of the Executive Order. California currently has 40,000 ZEVs on its roadways, more than any other state.

To ensure hydrogen fueling infrastructure is in place for the market launch of fuel cell vehicles, the Legislature authorized up to $20 million per year in funding for at least 100 hydrogen stations as part of Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013), which reauthorized funding for alternative fuels and vehicle rebates.

More information on the Advanced Clean Cars program can be found at:
http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm

Transportation Sector - Measures Identified in Scoping Plan

T-2: Low Carbon Fuel Standard Regulation

Background

The Board approved the Low Carbon Fuel Standard (LCFS) regulation in April 2009. LCFS sets declining carbon intensity (CI) targets between 2011 and 2020 and is designed to reduce the GHG emissions intensity of transportation fuels used in California by at least 10 percent by 2020.

The regulation establishes annual performance standards that fuel producers and importers must meet beginning in 2011. The standards are “back-loaded,” in which greater reductions are required in the last five years than the first five years. This schedule allows for the development of advanced fuels that are lower in carbon than today’s fuels and the penetration of plug-in hybrid electric vehicles, battery electric vehicles, fuel cell vehicles, and flexible fuel vehicles. The LCFS applies, either on a compulsory or opt-in basis, to all fuels used for transportation in California. These transportation fuels include California reformulated gasoline, California ultra-low-sulfur diesel fuel, biodiesel, renewable diesel, E85, compressed or liquefied natural gas, biogas, electricity, and compressed or liquefied hydrogen.

Status

Providers of transportation fuels must demonstrate that the mix of fuels they supply meets LCFS CI standards for each annual compliance period. Each fuel in the mix is assigned a CI value, based on the “life cycle” GHG emissions associated with the production, transportation, and use of fuels in motor vehicles. Each fuel's complete life cycle, from "well-to-wheels" (or from "seed-to-wheels" for biofuels made from crops), represents that fuel's "fuel pathway." To date, there are more than 200 individual fuel pathways that regulated parties can use to describe the GHG emissions associated with their fuels.

ARB is closely monitoring the status of regulated parties in the reporting tool. As of the end of Quarter 3 in 2013, there are approximately 2.04 million “excess” credits in the system—that is, more total credits than deficits. This means that regulated parties are over-complying with the LCFS, generating additional LCFS credits that can be used for future compliance when the standard becomes more stringent. In addition to the banked credits, regulated parties have begun trading credits.

On July 15, 2013, the State of California Court of Appeal, Fifth Appellate District (Court) issued its opinion in POET, LLC versus California Air Resources Board (2013) 218 Cal.App.4th 681. The Court held that the LCFS would remain in effect and that ARB can continue to implement and enforce the 2013 regulatory standards while it corrects the California Environmental Quality Act and Administrative Procedures Act shortcomings associated with the original adoption of the LCFS regulation. To address

the ruling, ARB staff is proposing to re-adopt the LCFS regulation in 2014 along with a suite of amendments to offer additional flexibility, update critical technical information, and provide for improved efficiency and enforcement of the regulation.

ARB is continuing its collaboration with stakeholders to evaluate the CI for crude oils, and working with interested parties on technical assessments related to low-energy-use refining, pursuant to the Board's direction. ARB is also continuing to analyze and recommend for approval numerous lower-CI fuel pathways for which fuel producers have applied, confirming that innovation is occurring in the production of these fuels. Furthermore, ARB is working with various universities to update the indirect land use change (iLUC) values for corn ethanol, sugarcane ethanol, and soy biodiesel, while also developing iLUC values for palm oil, canola oil, and sorghum. Recommendations on iLUC values will undergo independent academic review. Finally, ARB staff is looking at including a cost-containment provision for the LCFS and a methodology that would allow refineries to generate credits for investments at the refinery that reduce GHG emissions.

More information on the LCFS can be found at: http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

Transportation Sector - Measures Identified in Scoping Plan

T-3: Regional Transportation-Related Greenhouse Gas Targets

Background

In September 2010, the Board approved per-capita passenger vehicle GHG emission reduction targets for 2020 and 2035 for each of the 18 federally-designated Metropolitan Planning Organization (MPO) regions in California as required by the Sustainable Communities and Climate Protection Act of 2008 (SB 375; Steinberg, Chapter 728, Statutes of 2008). The goal of SB 375 is to reduce GHG emissions from passenger vehicles through better-integrated regional transportation, land use, and housing planning that provides easier access to jobs, services, public transit and active transportation options. Regional and local planning agencies are responsible for developing Sustainable Communities Strategies (SCS) as part of the federally-required Regional Transportation Plan and also responsible for developing State-required general plan housing elements. SCSs are intended to promote more travel and housing choices through greater access to alternative forms of transportation (including public transit, biking, and walking) and development patterns where people can live, work, and play without having to drive great distances. Implementation of these strategies hinges on local actions to realize the GHG emission reductions envisioned in the regional SCSs. SB 375 implementation strategies are designed to support local development of "transit priority projects," or transit-oriented development (TOD).

Each MPO is required to adopt and submit to ARB an SCS with its quantification of the region's forecasted per-capita passenger vehicle GHG emissions. ARB must accept or reject an MPO's determination that its SCS would, if implemented, meet the targets. In July 2011, ARB staff released a methodology that details how ARB will evaluate

regional SCSs in order to fulfill its responsibility under the law. An MPO must develop an alternative planning strategy if its SCS fails to meet ARB targets.

Status

MPOs are now in the process of developing and adopting their SCSs as part of their regular Regional Transportation Plan updates. Seven MPOs have adopted their first SCSs, all of which have demonstrated that they could meet or exceed their targets. These seven are the San Diego Association of Governments (adoption 2011), the Southern California Association of Governments (2012), the Sacramento Area Council of Governments (2012), the Bay Area Metropolitan Transportation Commission (2013), the Tahoe Metropolitan Planning Organization (2012), the Butte County Association of Governments (2012) and the Santa Barbara County Association of Governments (adoption 2013).

In mid- to late 2014, SCSs will be completed and adopted by the eight MPOs in the San Joaquin Valley, and by smaller MPOs including those for the Shasta, San Luis Obispo, and Monterey Bay regions. As each of these MPOs adopts its SCS, ARB staff will evaluate the plan to determine whether it, if implemented, would achieve the GHG emission targets. Meanwhile, the MPOs in the San Diego, Southern California, and Sacramento regions are already beginning work on their next Regional Transportation Plan updates which will entail updating their SCSs.

In January 2014, the Board received a briefing on the status of SB375 implementation, and directed staff to evaluate the need for revising the GHG reduction targets and return with recommendations in the fall 2014 timeframe. Staff's evaluation process will involve significant input from a wide range of stakeholders through a roundtable process beginning in the spring of 2014.

More information on the Sustainable Communities Program can be found at: http://www.arb.ca.gov/cc/sb375/sb375.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-4-1: Tire Pressure

Background

In March 2009, the Board approved the Under Inflated Vehicle Tires regulation. This program reduces GHG emissions by reducing the consumption of fuel from passenger vehicles operating with under inflated vehicle tires. Proper tire inflation decreases the tire rolling resistance and reduces fuel consumption. The Regulation became effective in September 2010.

More information on this program can be found at: http://www.arb.ca.gov/cc/tire-pressure/tire-pressure.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-4-2: Fuel Efficiency Tire Program

Background

This program would develop a statewide tire energy efficiency program for replacement tires on passenger cars and light-duty trucks.

This program is on hold. The United States Department of Transportation (National Highway Traffic Safety Administration) may propose a national fuel efficient tire program. If and when federal action is taken, a state program will be adopted.

More information on this program can be found at:
http://www.energy.ca.gov/transportation/tire_efficiency/index.html.

Transportation Sector - Measures Identified in Scoping Plan

T-4-3: Low Friction Oil

Background

This measure would require the use of low friction engine oils in passenger cars to reduce engine load and fuel use. ARB staff expects engine manufacturers to design their engines to accommodate the use of low friction oil to meet the Advanced Clean Cars requirements.

More information on the Advanced Clean Cars program can be found at:
http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm

Transportation Sector - Measures Identified in Scoping Plan

T-4-4: Solar Reflective Automotive Paint and Window Glazing

Background

ARB staff initiated a Cool Cars rulemaking in 2009, but ceased rulemaking activities in 2010 due to insufficient time remained on the rulemaking calendar to achieve consensus on the rule. In its place, staff incorporated a performance-based approach to cooling vehicle interiors into the advanced clean cars regulations which were approved by the Board in January 2012.

More information on the Advanced Clean Cars program can be found at:
http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm

Transportation Sector - Measures Identified in Scoping Plan

T-5: Ship Electrification at Ports (Shore Power)

Background

In December 2007, the Board approved the Shore Power Regulation, which requires the reduction in emissions of oceangoing vessels while at-berth at a California port. The regulation affects operators of container vessels, passenger vessels, and refrigerated-cargo vessels that berth at the ports of San Diego, Los Angeles, Long Beach, Hueneme, Oakland, and San Francisco. Operators of terminals servicing these vessels while at these ports are also affected.

The regulation provides vessel fleet operators visiting affected ports two options to reduce at-berth emissions from auxiliary engines: 1) turn off auxiliary engines for most of a vessel's stay in port and connect the vessel to some other source of power, most likely grid-based shore power, or 2) use alternative control technique(s) that achieve equivalent emission reductions. Each option has specific compliance requirements and dates. Most shipping companies will comply with the regulation using the reduced onboard power generation option.

Status

Beginning January 1, 2014, affected fleets were required to reduce emissions from auxiliary engines while at-berth by 50 percent per quarter. For most affected fleets, this is the first time that they will have reduced emissions while at-berth.

Annual compliance statements for affected fleets are due to the ARB starting April 1, 2015. Beginning 2017, fleet emission reduction requirements increase to 70%. The regulation will reach full implementation by 2020 when the fleet emission reduction requirements increase to 80%.

More information on the Shore Power regulation can be found at: http://www.arb.ca.gov/ports/shorepower/shorepower.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-6: Goods Movement Efficiency Measure

Background

The Goods Movement Efficiency Measure includes measures to reduce emissions from the equipment or vehicles transporting freight to and from ports, intermodal rail yards, and distribution centers. The measure envisioned additional reductions from ships, port trucks, long-haul trucks, commercial harbor craft, cargo handling equipment, transport refrigeration units, and locomotives, as well as system-wide reductions from overall improvements in freight movement efficiency. Work has been completed or is underway on various elements of T-6 including implementation of the drayage truck regulation, and efforts to introduce more efficient engines (like hybrids) to freight transport, conducting a technical analysis of vessel speed reduction programs, bringing cleaner ships to California, reducing idling of cargo equipment, reducing emissions

through incentive programs, and transitioning away from use of diesel powered refrigeration units for cold storage. Because ARB is on course to reach its 2020 GHG emission limit without the full reductions from Measure T-6, efforts to achieve transformative reductions from this sector are being folded into a broader ARB Sustainable Freight Strategy (Strategy) that will look beyond 2020.

The 2014 Strategy is a concentrated, one-year effort to produce a document developed in the context of a broader Sustainable Freight Initiative—which is a multi-decade effort to develop, fund, and implement the changes necessary to achieve a sustainable freight system—and represents the next milestone in defining what is necessary to move California toward a sustainable freight system. Building a coalition of freight stakeholders is a primary focus of the Strategy, and will ultimately be a significant driving force behind affecting change in areas outside of ARB's sphere of influence, including advocating at the federal level and acquiring public and private funding for implementation.

Status

The South Coast Zero-Emission Freight Transport Technology Symposium and ARB's Haagen-Smit Symposium in mid-2013 provided early input into the sustainable freight effort. Currently, there are a number of existing venues led by both public and private entities where California freight issues are being discussed. The California Freight Advisory Committee, established in 2013 to inform Caltrans' California Freight Mobility Plan, is one of the venues ARB is participating in with a focus on transportation infrastructure.

In January 2014, the Board received a briefing on the Strategy and directed staff to complete the following:

- Engage stakeholders to provide input on the development of a Strategy document that will be presented to the Board in late 2014. The document should identify and prioritize actions to move California towards a sustainable freight transport system and build a coalition to affect change outside of ARB's immediate sphere of influence.
- Complete sector-based technology assessments; undertake a systems analysis; consider "well-to-wheels" pollution impacts; and use the stakeholder outreach to identify techniques for improving efficiency at the business, sector, and system levels. This work will inform the Strategy and future State Implementation Plan and Scoping Plan development.
- Identify and implement near-term actions to reduce localized risk in communities near freight facilities. Begin development of broad principles and criteria for new and expanded freight facilities.
- In coordination with Caltrans and the California Freight Advisory Committee, develop principles and criteria that establish air quality and climate benefits as equal metrics to established transportation/mobility metrics in determining the priority of freight-related transportation projects.

- Coordinate planning with State energy agencies to meet the energy requirements of a sustainable freight system.
- In coordination with the local air districts, evaluate and implement opportunities to prioritize transformative zero and near-zero emission technologies for incentive funding programs.

More information on the Sustainable Freight Transport Initiative can be found at: http://www.arb.ca.gov/gmp/sfti/sfti.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-7: Heavy-Duty Vehicle GHG Emission Reduction Regulation

Background

The Heavy-Duty Vehicle GHG Emission Reduction Regulation (Tractor-Trailer GHG Regulation) was approved by the Board in December 2008. The purpose of the regulation is to reduce GHG emissions from certain long-haul tractor-trailer combinations that operate in California by requiring them to utilize technologies that result in improved fuel efficiency.

The regulation requires owners of long-haul tractors as well as 53-foot or longer box-type trailers to replace or retrofit their affected vehicles with compliant aerodynamic technologies and low rolling resistance tires. These requirements pertain to all applicable tractors and box-type trailers that operate on California highways regardless of where the vehicles are registered, although there are provisions specific to large and small fleets. All aerodynamic and tire technologies must be verified by the United States Environmental Protection Agency's SmartWay program.

In September 2011, U.S. EPA adopted a new regulation for controlling GHG emissions from new medium and heavy-duty engines and vehicles, known as the federal Phase 1 GHG regulation. The federal Phase 1 GHG regulation is currently in the implementation phase, with compliance requirements beginning with the 2014 model year and increasing in stringency through the 2018 model year. Manufacturers are expected to comply with Phase 1 with use of more efficient engines, use of auxiliary power units, mass reduction, low rolling resistance tires, improved aerodynamics, improved transmissions, and reduced accessory loads.

Status

Trailer fleet registrations for both Large Fleet Compliance Plan options and the Small Fleet Compliance Plan have been completed. A total of 310 large fleets with approximately 234,000 trailers and 2,237 small fleets with 7,325 trailers are registered and participating in the compliance plans. To date, 50 percent of the trailers registered in Option 1 of the Large Fleet Compliance Plan, 60 percent of the trailers registered in Option 2 of the Large Fleet Compliance Plan, and 25 percent of the trailers registered in the Small Fleet Compliance Plan were required to comply with the aerodynamic

technology requirements. Also, 2011 and later model year sleeper cab tractors and box-type trailers were required to comply as of January 1, 2010.

In December 2013, ARB approved new regulations to align California's GHG emission standards and test procedures with those of the federal Phase 1 GHG regulation. ARB also modified the Tractor-Trailer GHG Regulation to be consistent with the federal Phase 1 GHG regulation, including sunsetting the requirements for new 2014 and newer sleeper cab and day cab tractors. This will provide nationwide consistency for engine and vehicle manufacturers, and allow ARB to both certify new motor vehicles and new motor vehicle engines to GHG standards and to enforce those requirements.

U.S. EPA and NHTSA are now at work on a next round of stricter GHG standards for new medium and heavy-duty engines and vehicles, called Phase 2, which the federal agencies plan to propose in 2015 and which may include new national GHG emission reduction requirements for trailers. ARB staff is working closely with U.S. EPA and NHTSA to develop Phase 2. ARB expects that Phase 2 of the regulation will be considered for adoption by the Board in 2016.

More information on the Tractor-Trailer GHG Emission Reduction Regulation can be found at: http://www.arb.ca.gov/cc/hdghg/hdghg.htm. More information on ARB harmonizing with the federal Phase 1 GHG regulation can be found at: http://www.arb.ca.gov/msprog/onroad/phaselghg/phaselghg.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-8: Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)

Background

The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) was first approved by the Board in April 2009 as part of the Air Quality Improvement Program (AQIP) Funding Plan for Fiscal Year 2009-10. The AQIP was established by the California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (Assembly Bill 118, Statutes of 2007, Chapter 750). The purpose of HVIP is to accelerate the California deployment of commercialized hybrid and zero-emission medium and heavy-duty vehicles.

HVIP provides vouchers on a first-come, first served basis to help California fleets purchase an eligible new hybrid or zero-emission truck or bus. Vouchers are provided for approximately half of the incremental cost of the advanced technology vehicle.

Status

HVIP was launched in February 2010 and plays a critical role in accelerating early market penetration of hybrid and zero-emission truck and bus technology. The use of these advanced technology trucks results in GHG and criteria pollutant emission reduction benefits; increased fuel efficiency and fuel savings for fleets; and the creation of jobs related to vehicle production.

To date, nearly 1,700 vouchers have been issued over the life of the program (over 1,300 for hybrid trucks and nearly 400 for zero emission trucks). HVIP funding was exhausted in spring 2013. However, $5 million in additional HVIP funding was approved as part of the AQIP Funding Plan for Fiscal Year 2013-14, along with an additional one time $10 million appropriation from the Legislature (Senate Bill 359; Corbett, Chapter 415, Statutes of 2013), and HVIP will re-launch in spring 2014.

More information on the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project can be found at: http://www.arb.ca.gov/msprog/aqip/hvip.htm.

Transportation Sector - Measures Identified in Scoping Plan

T-9: High Speed Rail

Background

The California High-Speed Rail Authority (Authority) is responsible for planning and constructing an intercity high-speed rail system that would link the state's major population centers. The Authority is working with local transit, agriculture entities, northern and southern California railroads, small businesses, and cities and counties to upgrade and seamlessly connect other transit networks with the high-speed rail system to create and reinforce clean transportation options for Californians.

Capital funding to develop the high-speed rail project will come from federal, state, local and private sources. These funds will be available at different times based on the development timeline of the system.

Status

The Authority's 2012 Business Plan laid the foundation for a statewide rail modernization program that calls for parallel strategic investments in urban, commuter, and intercity rail systems, which will provide improved connectivity to the high speed rail system. The 2012 Business Plan outlines the timeline for the high-speed rail system implementation. The phased sections of the project are, the Initial Operating Section (IOS), Bay to Basin, and Phase 1 Blended.

In 2008, voters approved Proposition 1A, authorizing nearly $10 billion in state bonds for the United States' first high-speed rail (HSR) line, which would connect the San Francisco Bay Area with Los Angeles. The first construction contract to begin

California's high-speed rail system was awarded in August 2013, for work in the Central Valley. Additionally, environmental work is proceeding to electrify the Caltrain corridor in the Bay Area by 2019 as part of the high-speed rail system. The Authority will continue construction of the HSR system, beginning with completion of all station-area planning by 2017 followed by completion of the IOS in 2022. By 2029, HSR will run from San Francisco to Los Angeles.

More information on the high speed rail program can be found at: www.hsr.ca.gov.

C. Electricity and Natural Gas Sector

The status of each electricity and natural gas measure in the initial Scoping Plan is summarized in Table 2 below:

Table 2: Status of Electricity and Natural Gas Measures

Electricity and Natural Gas Measures		Status of Measure
E-1	1. Building Energy Efficiency – Electricity	2013 Building standards adopted and begin implementation July 1, 2014.
	2. Appliance Energy Efficiency Standards – Electricity	CEC adopted and implemented standards for many types of appliances. Most recently for battery chargers and television sets. New standards for other appliances are currently under development.
	3. Utility Energy Efficiency Programs – Electricity	Programs being implemented.
CR-1	1. Building Energy Efficiency – Natural Gas	2013 Building standards adopted and begin implementation July 1, 2014.
	2. Appliance Energy Efficiency – Natural Gas	New standards under development.
	3. Utility Energy Efficiency Programs – Natural Gas	Programs being implemented.
CR-2	Solar Water Heating (CSI Thermal Program)	Program being implemented. 1,800 projects to date.
E-2	Combined Heat and Power	AB1613, enacted in 2007, being implemented. CPUC adopted standard contracts for CHP systems and set targets for CHP procurement.
E-3	33 Percent Renewable Portfolio Standard	SBx1 2, enacted in 2011, being implemented by CPUC, CEC, and publicly-owned utilities.
E-4	Senate Bill 1 Million Solar Roofs (California Solar Initiative, New Solar Home Partnership, Public Utility Programs) and earlier solar programs.	More than 2,000 MW installed to date.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-1 and CR-1: Building Energy Efficiency Standards (electricity and natural gas)

New Buildings

The California Energy Commission (CEC)'s Building Energy Efficiency Standards provide a host of environmental benefits for the State. The Building Energy Efficiency Standards are updated on an approximate three-year cycle. The 2013 Standards will continue to improve upon the current 2008 Standards for new construction of, and additions and alterations to, residential and nonresidential buildings. The 2013 Standards will go into effect on July 1, 2014. The new standards are 25 percent more efficient for residential construction and 30 percent more efficient for non-residential construction.[1]

Existing Buildings Retrofits

Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009), requires CEC to develop and implement a comprehensive energy efficiency program for all of California's existing buildings. CEC has conducted a pilot of different energy efficiency and finance programs using American Recovery and Reinvestment Act (ARRA) funds. The CEC is currently drafting an AB 758 Action Plan to accomplish the following:

- Improve code compliance rates with Title 24 Building Standards for existing building upgrade projects.
- Develop energy disclosure approaches and programs that build on existing efforts and expand the types of applicable buildings, including State buildings in alignment with Governor Brown's Executive Order B-18-12.[2]
- Collaborate with the real estate and property management industries to craft aggressive, but practical, solutions to achieve efficiency upgrades in existing buildings.
- Enhance usability of Title 24 Building Standards as applied to additions and alterations of existing buildings.

Zero Net Energy

In 2008, the California Public Utilities Commission (CPUC) set forth ZNE goals in its long-term Energy Efficiency Strategic Plan and implementation roadmap for the Big Bold Energy Efficiency Strategies. CPUC's Big Bold Energy Efficiency Strategies, later updated in 2011, states that all new residential buildings shall be ZNE by 2020, new commercial buildings shall be ZNE by 2030, and half of existing commercial buildings shall be retrofitted to ZNE by 2030.

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[1] Computed from *California Energy Demand, 2012–2022 Final Forecast*, June 2012, Form 2.2 on Committed Energy Impacts.

[2] Executive Order B-18-12, issued on April 25, 2012. See http://gov.ca.gov/news.php?id=17508

CEC has made progress toward achieving the state's ZNE goals for new residential and new commercial buildings through triennial updates to the State's building energy efficiency standards. Working with CPUC, CEC developed a definition for ZNE Code compliant buildings that was published in the 2013 Integrated Energy Policy Report. Additionally, CEC and CPUC released the New Residential Zero Net Energy Action Plan in October 2013, which is designed to build a foundation for the development of a robust and self-sustaining ZNE market for new homes over the next seven years and to meet the State's goal that all new homes are zero net energy beginning in 2020.

More information on these programs can be found at:
Building Energy Efficiency Standards: http://www.energy.ca.gov/title24/.
AB 758: http://www.energy.ca.gov/ab758/.
Zero Net Energy:
http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/res_zne_action+plan.htm.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-1 and CR-1: Appliance Energy Efficiency Standards (electricity and natural gas)

Background

CEC regulates appliances sold in California through the following procedures:

- Sets maximum energy or water usage levels.
- Sets minimum energy efficiency design requirements.
- Maintains a database of certified appliances.
- Prohibits the sale of noncompliant and noncertified appliances.

The appliance energy efficiency standards apply to all state and federally regulated appliances sold or offered for sale in California with the exception of appliances sold wholesale in California with final retail sale outside the State and appliances designed and sold exclusively for use in recreational vehicles or other mobile equipment. Any entity purchasing such appliances will be affected by the program.

Status

Recent appliance standards adopted by CEC include:

- 2009 television energy efficiency standards.
- 2012 battery charger energy efficiency standards.

CEC is currently considering additional appliance types for coverage under California's appliance energy efficiency standards. Appliances being considered include:

- Consumer electronics (including computers, displays, game consoles, and network equipment.

- Lighting (fluorescent dimming ballasts, light-emitting diodes, and multifaceted reflector lamps).
- Water appliances (faucets, toilets, urinals, and water meters).
- Other appliances (commercial clothes dryers, air filter labeling, residential pool pumps and motors, portable electric spa labeling).

The Federal Department of Energy occasionally elevates California standards that are proven feasible to be national standards, thus significantly increasing the impact of California's efforts.

More information on CEC's Appliance Energy Efficiency Standards can be found at: http://www.energy.ca.gov/appliances/.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-1 and CR-1: Publicly-Owned Utilities Efficiency Programs (electricity and natural gas)

Background

Energy efficiency is the State's number one priority for procuring new energy resources to meet California's electricity and natural gas demand. Assembly Bills 2021 (Levine, Chapter 734, Statutes of 2006) and 2227 (Chapter 606, Statutes of 2012) directed CEC, CPUC, and the State's publicly-owned electric utilities (POUs) to develop statewide estimates of all potentially achievable cost-effective electricity and natural gas efficiency savings and establish targets in order to reduce total state forecasted electrical energy consumption by ten percent over ten years.

Status

Utilities collect funding for their energy efficiency programs through a public goods charge which varies by utility, and some utilities make investments beyond the public benefits fund. CEC collects information on POU investments in energy efficiency and demand reduction programs, similar to information CPUC collects from the investor-owned utilities (IOUs).

More information on CEC's Energy Efficiency programs can be found at: http://www.energy.ca.gov/efficiency/.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-1 and CR-1: Investor-Owned Utilities Efficiency Programs (electricity and natural gas)

Background

The IOU energy efficiency portfolio provides approximately $1 billion in annual funding for a range of activities to promote market transformation of energy efficiency as well as direct resource acquisition of energy savings. The programs account for approximately 1000 gigawatt hours (GWh) of additional energy savings installed annually, which is roughly enough electricity to power 100,000 homes. The portfolio of programs covers all customer sectors—residential, commercial, agricultural, and industrial sectors with a wide range of initiatives. These include:

- Customer rebates for all cost-effective energy efficiency measures
- Energy audit programs
- Marketing outreach and education
- Financing programs
- Emerging technology programs
- Codes and standards advocacy
- Workforce education and training programs
- Government partnership programs and independently administered programs through regional energy networks
- Lighting and heating, ventilation and air-conditioning (HVAC) market transformation programs
- Third party programs to reach specialized markets
- Program pilots to test new approaches and delivery mechanisms

CPUC is currently coordinating with CEC in the planning and implementation of AB 758 to identify strategies that apply to IOU programs.

Status

Evaluation of the 2010 – 2012 program cycle is expected to be released in early 2014. Funding for 2015 is expected to be approved in June 2014.

The energy efficiency evaluation reports can be found at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/.

Performance statistics on California's Energy Efficiency Programs can be found at: http://www.eestats-beta.com/.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

CR-2: California Solar Initiative--Thermal Program

Background

The California Solar Initiative-Thermal (CSI-Thermal) program was implemented to develop a market for solar water heating and other solar thermal technologies in California via financial incentives, standards, marketing, and outreach. The goal of the

program is to install the equivalent of 200,000 residential solar water heating systems by 2018 within IOU service areas.

The CSI-Thermal program was authorized by Assembly Bill 1470 (Huffman, Chapter 536, Statutes of 2007), which allocates $250 million collected from natural gas ratepayers for solar thermal systems that offset natural gas use, and Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), which authorizes up to $100.8 million for solar thermal systems that offset electric use. The sunset date for the program is December 31, 2017.

Status

The CSI-Thermal program administrators are required to submit quarterly program implementation reports to CPUC. To date, the program has incentivized over 1,800 projects with roughly $30 million in incentives committed to systems displacing natural gas and $40,000 to systems displacing electricity or propane.

In addition, CPUC has recently issued a report on the CSI-Thermal Program and its progress towards statutory goals pursuant to AB 2249 (Buchanan, Chapter 607, Statutes of 2012). The report issued February 1, 2014, finds that there has been moderate success with multi-family and commercial installations, but very little participation among single-family customers, despite incentive levels being raised by the Commission in 2012. It also notes that achievement of the overall goal is unlikely, although the new offering of incentives for non-single-family swimming pools may spur greater program participation.

In response to AB 2249, CPUC modified the program to allow funding for non-single-family residence solar pool heating. That program was launched in January 2014, with no participation data yet available.

More information on the CSI-Thermal Program can be found at: www.csithermal.com.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-2: Combined Heat and Power (CHP) Systems

Background

Through the implementation of the 2007 Waste Heat and Carbon Emissions Reduction Act (AB 1613; Blakeslee, Chapter 713, Statutes of 2007), CEC and CPUC have taken steps to create efficiency guidelines and market pricing incentives for small (<20 MW) CHP system owners by creating a market for the purchase of any excess electricity generation (that is beyond the operational needs of the host facility and available for export to the grid) through utility provided feed-in tariff pricing. The Act applies to highly efficient CHP systems with 20 megawatts (MW) or less of generating capacity installed on or after January 1, 2008.

CPUC adopted the CHP "Settlement Agreement" in 2010, which created a new CHP program requiring that California's three largest IOUs procure a minimum of 3,000 MW of CHP capacity by 2015 and additionally to reduce GHG emissions by 4.8 MMTCO2e through contracts with CHP facilities by 2020. CPUC may authorize the procurement of additional capacity in its 2014 Long Term Procurement Planning proceeding to meet the GHG emission reduction target or the remainder of the 2015 MW target.

Status

CEC approved efficiency and certification guidelines for eligible systems under AB 1613 in January 2010, and in 2011, CPUC adopted standardized contracts and pricing for the purchase of electricity from CHP customers operating within the IOUs' service areas.

Under CPUC Settlement Agreement, the IOUs submit semi-annual reports to document progress toward the MW and GHG emission reduction targets. As of March 2013, the IOUs have executed agreements with CHP Facilities for 2,067 MW of capacity and 1.46 MMTCO2e of GHG emission reductions. These procurements represent progress of 69 percent and 30 percent, toward the two respective targets.

More information on the status of the AB 1613 program and the CHP Settlement Agreement can be found at: www.cpuc.ca.gov/PUC/energy/CHP/.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-3: 33 Percent Renewable Portfolio Standard

Background

The State's original Renewable Portfolio Standard (RPS) program, initiated in 2002, required the State's IOUs and other electric retail sellers to procure at least 20 percent of the electricity sold to their retail customers from eligible renewable energy resources by the year 2017, which was later accelerated to 2010. The original RPS mandate encouraged but did not require local POUs to do the same. In 2011, SBx1 2 (Simitian, Chapter 1, Statutes of 2011) modified the program to increase the targets and extend the requirements to local publicly-owned utilities with the goal of the program being that at least 33 percent of a utility's annual retail sales are procured from renewable resources by the year 2020.

The RPS program is implemented collaboratively by CEC and CPUC. CEC determines the RPS resource eligibility and procurement verification. CEC also establishes regulations to enforce the RPS program for the State's local POUs, with ARB responsible for determining appropriate penalties for any noted violations. CPUC determines RPS procurement targets, procurement and compliance rules and monitors and enforces program compliance for the State's IOUs and other electric retail sellers (i.e., electric service providers and community choice aggregators).

Status

To date, CEC and CPUC have accomplished the following tasks in implementing the revised program:

- *RPS Eligibility Guidebook*: CEC is currently using the seventh edition of the RPS Eligibility Guidebook, which was adopted in April of 2012. A scoping workshop was held in January 2014 to identify issues that may be addressed in an eighth edition of the guidebook.

- *Regulations for the Enforcement of the Renewables Portfolio Standard for Local Publicly Owned Electric Utilities*: Final regulations for the enforcement of the RPS for local POUs were adopted by CEC in June 2013 and approved by the Office of Administrative Law's Notice Register in August of 2013. The regulations became effective in October of 2013.

- *RPS Verification Report:* This non-mandated report conveys to CPUC CEC's findings on eligible resource procurement for the RPS. The most recent report was transmitted to CPUC in late 2013 and covered procurement from 2008 through 2010.

- CPUC has adopted several Decisions implementing SB1x 2. Decisions (D.) 11-12-020 established RPS procurement quantity requirements, or targets, for retail sellers. D.11-12-052 defined and implemented new RPS procurement content categories. D.12-06-038 adopted new RPS compliance rules and reporting requirements for the retail sellers under CPUC's jurisdiction. In July 2013, CPUC released a rule requesting comments on a proposed methodology to limit the retail seller's procurement expenditures for the RPS. A proposed decision is anticipated in mid-2014. In November 2013, CPUC adopted D.13-11-024 authorizing the three large IOUs to hold solicitations for RPS procurement.

- CPUC has an active proceeding to implement the new RPS cost limitation and a feed-in tariff for new RPS-eligible bioenergy resources (SB 1122; Rubio, Chapter 612, Statutes of 2012).

California has made substantial progress in developing new in-state renewable generating resources to support the RPS goals. The State's operating renewable energy capacity increased from 14,100 MW in 2012 to 17,400 MW in 2013[3]. A total of 3,300 MW of renewable capacity came online during 2013, increasing California's renewable capacity by more than 20 percent. California is now the nation's second largest producer of wind power and home to the nation's largest wind facility.[4] [5]

[3] California Energy Commission, Renewable Tacking Progress, revised January 15, 2014.
[4] Wiser, Ryan, and Mark Bolinger. 2012. 2011 Wind Technologies Market Report. Lawrence Berkeley National Laboratories. U.S. Department of Energy. DOE/GO-102012-3472. August.
[5] California Energy Commission, Clean Energy Tour.

More information on the RPS program can be found at:
http://www.cpuc.ca.gov/PUC/energy/Renewables/.
http://www.energy.ca.gov/portfolio/index.html.

Electricity and Natural Gas Sector - Measures Identified in Scoping Plan

E-4: Million Solar Roofs

Background

The State's Million Solar Roofs program enacted by Senate Bill 1 in 2006 (Murray, Chapter 132) provides up to $3.3 billion in financial incentives for the installation of residential, commercial, and institutional solar PV systems. The program set a target for 3,000 MW of self-generative solar, including solar water heating, by 2017. The program is divided into three distinct program components each with a portion of the statewide budget and installation goals.

- The California Solar Initiative (CSI) implemented by CPUC with a $2.37 billion allocation, provides incentives for solar PV systems installed on existing residential and certain new and existing non-residential buildings within IOU service territories. The CSI program has a goal to install 1,940 MW of new solar by the end of 2016. The program provides solar consumers with up-front incentives for smaller systems or prorates incentives over five years for larger systems.

- The New Solar Homes Partnership (NSHP), with a $400 million allocation administered by CEC, provides financial incentives to customers within IOU service areas to install solar systems on new residential buildings. The NSHP has a goal of achieving 360 MW of installed solar electric capacity in California by the end of 2016.

- The local publicly-owned utility component of the program, with a $784 million allocation, requires the POUs to offer financial incentives for solar systems to customers within their service areas with a goal for installing 700 MW of solar by the end of 2016.

Status

The components of the million solar roofs program are administered by the Go Solar California campaign. To date, more than 2,000 MW of self-generating solar capacity has been installed under the incentives provided by this program and previous solar programs. To date, CPUC's CSI portion of the program has seen more than 1,400 MW of rooftop solar capacity installed.

More information on solar incentive programs can be found at:
www.gosolarcalifornia.ca.gov.

D. Water Sector

The status of each water measure in the initial Scoping Plan is summarized in Table 3 below:

Table 3: Status of Water Measures

Water Measures		Status of Measure
W-1	Water Use Efficiency	State agency actions to reduce water usage.
W-2	Water Recycling	State Water Resources Control Board (SWRCB) is funding recycled water development projects.
W-3	Water System Energy Efficiency	CEC has adopted standards for water efficiency. CPUC has ordered IOUs to invest in energy and water efficiency.
W-4	Reuse Urban Runoff	SWRCB is funding numerous stormwater reuse projects.
W-5	Renewable Energy Production	DWR is contracting from renewable energy projects. CEC is researching biogas technologies.
W-6	Water Public Goods Charge	The program has been evaluated but is not being implemented at this time.

Water Sector - Measures Identified in the Scoping Plan

W-1: Water Use Efficiency

Background

This measure promotes greater use of water conservation activities, including best management practices, and the implementation of the 2009 Water Conservation Act (Senate Bill x7-7; Steinberg, Chapter 4, Statutes of 2009). In November 2009, the Legislature passed SB x7-7 as part of a five-bill legislative package designed in part to improve the declining Sacramento-San Joaquin Delta's ecosystem and to increase the reliability of water export from the Delta. SBx7-7 specifically addresses urban and agricultural water conservation. The key urban provision is the establishment of a statewide goal to reduce urban per capita water use by 20 percent by 2020 (20x2020 project).

The California Department of Water Resources (DWR) is the lead State agency on the 20x2020 project. SB x7-7 directed DWR to develop guidelines and methodologies for suppliers to use in calculating per capita water use. If the State is not on track to achieve the goal, DWR will provide recommendations on steps the State could take to meet the goal in 2020.

SB X7-7 also directs urban water suppliers to calculate baseline per capita water use and set water use targets for 2015 and 2020. Suppliers not meeting their water use targets are ineligible for State water management grants and loans. Water suppliers report their baseline and target per capita water use in Urban Water Management Plans which are submitted to DWR every five years.

Status

To date, 407 total urban water suppliers have submitted urban water management plans to DWR representing close to 80 percent of California's population (DWR received 396 plans required from a total of 440). The statewide average baseline water use was 196 gallons per capita per day (gpcd). The State's 20 percent by 2020 goal is 164 gpcd, which if achieved, will result in an estimated 1.8 million acre feet of annual potable water demand reduction.

In April 2012, Governor Brown signed Executive Order B-18-12 requiring among other actions, State agencies to reduce agency-wide water use 10 percent by 2015 and 20 percent by 2020 as measured against a 2010 baseline. The Green Building Action Plan, which accompanies the Executive Order, directs DWR to develop guidelines and criteria by January 1, 2013. DWR has developed the guideline used by State agencies to improve water use efficiency and to recommend a third-party database for reporting and monitoring State facilities water use.

More information on DWR's Water Use-Efficiency program can be found at: http://www.water.ca.gov/wateruseefficiency/sb7/.

Water Sector - Measures Identified in the Scoping Plan

W-2: Water Recycling

Background

In 2009, the State Water Resources Control Board (SWRCB) passed a Recycled Water Policy that set ambitious goals to advance safe and reliable development of recycled water. The primary goals of this policy include:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet per year by 2020 and by at least two million acre-feet per year by 2030.
- Adopt Salt and Nutrient Management Plans to ensure water quality is maintained.
- Streamline permitting processes to facilitate recycled water development.

Status

In 2009, SWRCB conducted a survey to determine how much water is being reused statewide and for what purposes. The survey results indicated that 669,000 acre-feet of water had been recycled and used for various purposes.

SWCRB has awarded over $1 billion in loans and grants to date for recycling and stormwater capture infrastructure, and projects are coming online. In addition, DWR's Integrated Regional Water Management Grant Program includes funding support to facilitate recycled water development.

CEC provided funding for five research projects concerned with developing unconventional water resources as a replacement for fresh water in industrial processes, evaluating technologies that could reduce the energy required to treat wastewater, and using recycled water for renewable energy generating activities. The research is designed to help meet SWRCB-adopted recycled water and stormwater goals, and mitigate the challenges water districts will face from uncertain water supplies resulting from climate change.

More information can be found at:
http://www.swrcb.ca.gov/water_issues/programs/water_recycling_policy/index.shtml.
http://www.water.ca.gov/irwm/grants/.
http://www.energy.ca.gov/research.

Water Sector - Measures Identified in the Scoping Plan

W-3: Water and Energy Conservation

Background

This measure was designed to achieve GHG emission reductions by reducing the amount of energy, or carbon content of the energy, used to transport, use, and treat water within California. DWR, CEC, and CPUC have each pursued implementation activities under this measure.

Status

DWR has updated the California Water Plan, to include actions to: (1) exceed SB7X7 agricultural and urban water conservation and efficiency targets; (2) expand funding for water use efficiency research, development and implementation programs; (3) increase

water and energy efficiency coordination efforts; and (4) promote local conservation ordinances. In addition, DWR did not renew its partial interest in a Nevada coal-fired power plant, which supplied power for operation of the State Water Project. Instead, DWR is obtaining replacement power from a much lower emitting California-based natural gas-fired power plant, along with renewable energy from certified geothermal and landfill gas plants.

CEC funded 13 projects to improve water system energy efficiencies, evaluate water conservation strategies, and reduce the emissions associated with the treatment of water and wastewater. These projects have separate schedules with various phases of completion and separate milestones.

CPUC initiated a pilot program directing IOUs to develop partnerships with local water agencies and implement specific water conservation and energy efficiency programs, and measure the embedded energy savings, to better understand potential opportunities in the residential, commercial and industrial sectors. A calculator was also developed to determine the cost-effectiveness of each program, based on embedded energy savings potential. Nine Pilot projects were conducted in total; two to three projects by each IOU. These included, large commercial audits, high efficiency toilet installation (low income), emerging data technologies, emerging technologies for cooling towers, system wide leak/loss detection at a large water utility, and emerging technologies for outdoor landscaping.

CPUC also conducted a series of studies to better understand the energy intensity of different stages of the water use cycle in California, and to qualify and quantify the "energy embedded in water" during supply/conveyance, distribution/ treatment, and end use.

More information on the California Water Plan can be found at: http://www.waterplan.water.ca.gov/.
More information about CPUC's Water and Energy Conservation program can be found at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Water-Energy+Nexus+Programs.htm.
More information about these CEC research efforts can be found at: http://www.energy.ca.gov/research.

Water Sector - Measures Identified in the Scoping Plan

W-4: Storm Water Reuse

Background

The State's Stormwater Reuse program is designed to maximize the capture and infiltration of stormwater to increase local water supplies through the promotion of low-impact development. The State and Regional Water Quality Control Boards used their regulatory and funding programs to advance the goals of the program.

Status

The State and Regional Boards adopted permits for municipalities and industrial facilities, as well as Caltrans and general construction projects that improve water quality and generate additional infiltration. To date, SWRCB has awarded over $100 million in funding for numerous storm-water infiltration and reuse projects.

More information on the low-impact development and stormwater programs can be found at: http://www.waterboards.ca.gov/water_issues/programs/low_impact_development/index.shtml.

Water Sector - Measures Identified in the Scoping Plan

W-5: Renewable Energy Production from Water

Background

This program was designed to propose opportunities for developing renewable energy projects on lands associated with California's State and local water infrastructure.

Status

CEC recently financed public interest research and demonstration projects that focus on developing and demonstrating biogas technologies at wastewater plants to meet on-site electricity demand and supply the local electricity grid with excess generation. The research supports several efforts to improve renewable energy generation from wastewater treatment plants. For example, a hybrid combined heat and power project operated by the San Bernardino Municipal Water Department reforms biogas into a hydrogen-rich gas which is then blended with non-reformed biogas to create a fuel for reciprocating engines that will meet air quality standards.

Research has also been funded to improve the efficiency of existing hydropower generating facilities by employing real-time reservoir inflow forecasts at five northern California reservoirs. These reservoirs are major elements of both the federal Central Valley Project and California's State Water Project and represents almost 1,600 MW of hydropower capacity. This demonstration project is showing that through such an approach, hydropower generation can be increased substantially.

More information on this research can be found at: http://www.energy.ca.gov.

Water Sector - Measures Identified in the Scoping Plan

W-6: Public Goods Charge for Water

Background

The concept for this proposed program was to assess a fee on water district customers and apply the proceeds towards financing various water-related energy use reduction efforts. The proposed programs to be financed included the water efficiency, conservation, reuse and recycling programs discussed above, and which were included in the initial Scoping Plan.

Status

This program has not been implemented due to concerns raised about the feasibility of effectively structuring and implementing the program.

More information on this measure can be found at: http://www.waterboards.ca.gov.

E. Green Buildings

The status of each green buildings measure in the initial Scoping Plan is summarized in Table 4 below:

Table 4: Status of Green Building Measures

Green Building Measures		Status of Measure
GB-1	1. State Green Building Initiative: Leading the Way with State Buildings (Greening New and Existing State Buildings)	Green Buildings Executive Order B-18-12, signed April 2012.
	2. Green Building Standards Code (Greening New Public Schools, Residential and Commercial Buildings)	California Building Standards Commission adopted the 2010 CALGreen Code. 2013 CALGreen Code became effective January 1, 2014.
	3. Beyond Code : Voluntary Programs at the Local Level (Greening New Public Schools, Residential and Commercial Buildings)	Over 100 local governments have adopted green building standards that are more stringent than State standards.
	4. Greening Existing Buildings (Greening Existing Homes and Commercial Buildings)	Over 500 buildings have been certified to LEED-EB: O&M green building rating system.

Green Buildings - Measures Identified in the Scoping Plan

State Green Building Initiative

Background

In April 2012, Governor Brown signed Executive Order B-18-12 directing State agencies and departments to take immediate action for state government buildings to serve as models for green building. The EO requires State agencies to:

- Reduce grid-based energy purchases by at least 20 percent by 2018.
- Reduce entity-wide GHG emissions by 10 percent by 2015 and 20 percent by 2020.
- Participate in demand-response programs to reduce energy use in State-owned or leased facilities.
- Achieve Leadership in Energy and Environmental Design (LEED) “Silver” certification for new and renovated State-owned and leased buildings.
- Retrofit half of the existing buildings to be ZNE buildings by 2025.
- Install electric vehicle charging stations to accommodate future infrastructure demand.

Status

Since 2008, over 100 State buildings have achieved LEED certification. State agencies have been able to achieve a four percent reduction in total energy use and an 18 percent reduction in energy use intensity compared to a 2003 baseline, despite a 12 percent increase in State building square footage over that time.

In February 2013, a Sustainable Building Working Group initiated monthly meetings to provide technical assistance to implement the Governor's green building Executive Order and Action Plan goals. The working group reports to the Sustainability Task Force which provides executive level oversight. Department of General Services (DGS) created an Existing Building Policy Workgroup to develop specific policies and guidelines for existing state buildings. Each workgroup outlined high level policies for inclusion in the State Administrative Manual. All state agencies that own and operate buildings have also completed a Road Map that outlines the path forward to achieve all of the green building EO goals.

More information on the State Green Buildings Initiative can be found at: http://www.green.ca.gov.

Green Buildings - Measures Identified in the Scoping Plan

Green Building Standards Code

Background

This measure addresses the development of consistent mandatory green building standards for all building types. The California Building Standards Commission (CBSC) adopts and implements the Building Standards Code (Title 24, California Code of Regulations). The Green Building Standards (CALGreen) Code is a subpart of the California Building Standards Code.

Multiple agencies assist in the development of the CALGreen Code. CBSC develops building standards for commercial buildings. The California Department of Housing and Community Development (HCD) develops the green building standards for residential

construction. The Division of the State Architect (DSA) develops building standards for school construction. The Office of Statewide Health Planning and Development (OSHPD) develops green building standards for hospitals. CEC is responsible for developing the energy efficiency standards portion of the CALGreen code for residential and nonresidential.

Status

Originally adopted in 2008, the CALGreen Code included all voluntary standards that went beyond the basic building code requirements and introduced new standards for reducing water use, provisions for reducing and recycling construction and demolition waste, criteria for site development to locate buildings near public transit, and measures for improving indoor air quality to protect the health of building occupants. In 2010, the CALGreen Code became mandatory on a statewide basis. The 2010 code, as amended, included provisions for additions and alterations for non-residential buildings, but it still only applied to new construction for low-rise residential buildings. For the 2013 code, effective January 2014, the scope of the CALGreen Code was expanded to all residential buildings, including high-rise residential, as well as to additions or alterations with increases in conditioned space. In addition to mandatory standards, the CALGreen Code still includes voluntary standards, also known as Tiers, that offer model building code language available for local adoption.

More information on CALGreen can be found at:
http://www.bsc.ca.gov/Home/CALGreen.aspx.

Green Buildings - Measures Identified in the Scoping Plan

Beyond Code: Voluntary Programs at the Local Level

Background

The “Beyond Code” measure encourages voluntary efforts to go beyond mandatory building codes and standards for new residential and commercial buildings. In some cases, cities are adopting ordinances to exceed the Energy Code by fifteen or thirty percent. Some local governments are adopting the CALGreen voluntary tiers as mandatory. Other cities and counties are taking a third-party verified approach and adopting “beyond code” ordinances to mandate LEED for all new commercial construction and/or GreenPoint Rated for all new residential buildings. CEC approves “beyond code” ordinances adopted by local governments that are filed with the CBSC.

Similar to cities and counties, school districts have taken the initiative to achieve “beyond code” high performance standards. Many districts have passed resolutions for

all new construction to be certified to the Collaborative for High Performance Schools (CHPS) Criteria. CHPS criteria fundamentally changes the design, construction and operation of schools to conserve energy, water, and other natural resources as well as reduce waste, pollution, and environmental degradation. The State's higher education systems are also leaders in designing and constructing green buildings on their campuses.

Status

Over one hundred local governments have adopted "beyond code" green building standards. Twenty of those cities adopted building standards to exceed the Building Energy Efficiency Standards by 15 or 30 percent. About 50 cities and counties have standards exceeding the minimum CALGreen Code Tiers. Over 60 local governments have mandated all new construction to achieve third-party green building certification, such as the GreenPoint Rated program and the LEED rating system. In an effort to pursue high performance standards for greening public schools, about 40 school districts have mandated CHPS certification for all new construction and major modernization. Since 2008, nearly 200 schools in California have been recognized as CHPS schools. In higher education, the University of California has established a goal to achieve carbon neutrality in its operations by 2025. Around 40 buildings in the California State University System have achieved LEED certification.

More information on the Beyond Code program can be found at: http://www.arb.ca.gov/cc/greenbuildings/beyondcode.htm.

Green Buildings - Measures Identified in the Scoping Plan

Greening Existing Buildings

Background

While building standards for new construction are useful to reduce the impacts of climate change, existing buildings offer the greatest potential to reduce building-related GHG emissions. Energy efficiency retrofit programs provide a critical starting point to address GHG emissions of existing buildings. However, the intent of this measure is to encourage voluntary actions that achieve GHG emission reductions from reducing water use, waste generation, and transportation impacts. Many voluntary efforts are pursuing green building certification as a means to achieve this goal.

Status

A comprehensive existing building upgrade program is under development by the CEC; it is focused on stimulating and creating multiple pathways to achieve significant energy savings through energy efficiency upgrades. Other voluntary efforts underway are taking a more comprehensive approach to green existing homes and commercial buildings. Over five hundred buildings in California have been certified to the LEED-EB: O&M rating system, which certifies that a building's operations follow rigorous green building standards and practices.

F. Industry Sector

The status of each industry measure in the initial Scoping Plan is summarized in Table 5 below (The Cap-and-Trade program is discussed in Chapter IV of the Proposed Scoping Plan Update).

Table 5: Status of Industry Measures

Industry Measures		Status of Measure/Board Consideration Dates
I-1	Energy Efficiency and Co-Benefits Audits for Large Industrial Sources	July 2010
I-2	Oil and Gas Extraction GHG Emission Reduction	Expected 2014
I-3	GHG Emissions Reduction from Natural Gas Transmission and Distribution	Under evaluation
I-4	Refinery Flare Recovery Process Improvements	Equivalent measure implemented by local air districts
I-5	Work with the local air districts to evaluate amendments to their existing leak detection and repair rules for industrial facilities to include methane leaks.	Under evaluation in collaboration with local air districts

Industry Sector - Measures Identified in the Scoping Plan

I-1: Energy Efficiency and Co-Benefits Audits for Large Industrial Sources

Background

In July 2010, the Board approved the Energy Efficiency Assessment Regulation. The purpose of the regulation was for ARB staff to gather information on the full range of energy efficiency improvement projects and GHG emission reduction opportunities potentially available at California's largest industrial facilities and to identify what criteria pollutants and toxic air contaminants co-benefits could also be achieved.

The regulation requires affected facilities to conduct a one-time assessment of the facility's fuel and energy consumption, and emissions of GHG, criteria pollutants, and

toxic air contaminants. This assessment must also include the identification of potential energy efficiency improvement projects for equipment, processes, or systems that cumulatively account for at least 95 percent of the facility's total GHG emissions. The regulation affects all facilities with 2009 GHG emissions of 0.5 MMTCO2e or greater, and cement plants and transportation fuel refineries with 2009 GHG emissions of at least 0.25 MMTCO2e.

Status

43 facilities submitted assessment reports to ARB, covering five industrial sectors: refinery, cement, hydrogen production, power generation, and oil and gas/mineral production. ARB is currently developing public reports for each industrial sector, summarizing the information provided by the facilities. Two reports have been released, and the remaining three are anticipated to be released in 2014. After their release, ARB will develop preliminary findings and recommendations for all of the sectors. ARB will use these findings to identify the best approaches to secure energy efficiency improvements and the associated emission reductions at California's largest facilities.

More information on the Energy Efficiency Assessment Program can be found at: http://www.arb.ca.gov/cc/energyaudits/energyaudits.htm.

Industry Sector - Measures Identified in the Scoping Plan

I-2: Oil and Gas Extraction GHG Emissions Reduction

Background

This measure would address fugitive emissions from crude oil and natural gas production, processing, and storage operations. Oil and gas production comes from California's more than 50,000 oil wells and 1,500 gas wells, including off-shore platforms. The majority of the oil wells are located in southern California, while most of the gas fields are located in northern California. Currently, ARB staff is conducting studies aimed at evaluating potential reduction measures for GHG emissions from these operations. ARB staff has conducted a survey of the crude oil and natural gas industry to improve estimates of GHG emissions from this sector in California. Staff has also developed, in conjunction with local districts, stakeholders, and instrument manufacturers, two GHG and VOC testing procedures designed to quantify fugitive emissions from crude oil and produced water storage tank systems and leaking components.

Status

ARB undertook a survey of the industry to improve the emissions inventory for this sector. A report on the Oil and Gas Industry Survey results was released in December 2011. In June 2012, ARB staff released a new version of the test procedure for determining emissions of methane, carbon dioxide, and VOCs from crude oil and natural gas separation and storage tank systems. Staff intends to use the survey data

to explore the development of a control measure to reduce venting and fugitive GHG emissions associated with oil and gas production. These emissions come from various sources, such as compressor seals, storage tanks, and leaking components such as valves, flanges, and connectors. A proposed measure is scheduled for Board consideration in 2014.

More information on ARB's Crude Oil and Natural Gas Production, Processing, and Storage program can be found at: http://www.arb.ca.gov/cc/oil-gas/oil-gas.htm.

Industry Sector - Measures Identified in the Scoping Plan

I-3: GHG Emissions Reduction from Natural Gas Transmission and Distribution

Background

This measure addresses fugitive GHG emissions from natural gas transmission and distribution. There are about 215,000 miles of natural gas pipelines in California, consisting of approximately 13,000 miles of transmission, high pressure and large diameter pipeline, and more than 200,000 miles of distribution, low pressure and small diameter pipeline.

Status

In 2008, ARB staff surveyed entities that owned or operated gas pipelines in the State to collect activity data associated with natural gas transmission and distribution. Staff analyzed the data and identified three main emission sources: pipelines, compressor stations, and metering and regulating stations. Based on the survey, the vast majority of the GHG emissions from this sector, more than 80 percent, are from distribution pipeline leaks. Because the emission factors used to estimate these emissions are dated and not California-specific, ARB is currently updating these emission factors via field measurements of fugitive emissions from natural gas distribution pipelines in California. The field study is expected to be completed by 2015. ARB will use the study results to determine the cost-effectiveness of developing a regulation to reduce fugitive GHG emissions from these operations.

More information on the ARB's Natural Gas Transmission and Distribution program can be found at: http://www.arb.ca.gov/cc/gas-trans/gas-trans.htm.

Industry Sector - Measures Identified in the Scoping Plan

I-4: Refinery Flare Recovery Process Improvement

Background

This measure proposed to minimize GHG emissions by recovering gases before they are combusted by the refinery flare. A flare gas recovery unit collects the gas,

compresses it, cools it, and then sends it back to a refinery process, where the recovered gas can be used as refinery fuel gas or refinery feedstock.

Status

Using historical data, ARB had estimated in the initial Scoping Plan that GHG emission reductions could be achieved cost-effectively by installing additional flare gas recovery capacity to capture and reroute gases headed to the flare back to the refinery. However, in recent years, local air district flare emission reduction programs have significantly reduced routine flaring emissions from refineries. ARB does not believe that an additional statewide measure to address refinery flaring would be cost-effective at this time.

Industry Sector - Measures Identified in the Scoping Plan

I-5: Removal of Methane Exemption for Large Industrial Sources, including Refineries

Background

Under this measure, existing fugitive methane exemptions would be removed from local air district rules applicable to major industrial sources, including refineries. Because methane has very low photochemical reactivity, it does not contribute significantly to smog formation and has therefore been historically exempt from the local air districts' volatile organic compound (VOC) regulations, such as refinery leak detection and repair programs.

Status

Because methane is a short-lived climate pollutant, ARB is working with local air district staff to determine the benefits of incorporating amendments to their existing leak detection and repair rules to include methane leaks for refineries and other industrial sources with potential for fugitive methane emissions.

G. Recycling and Waste Management Sector

The status of each recycling and waste measure in the initial Scoping Plan is summarized below in Table 6.

Table 6: Status of Recycling and Waste Measures

Recycling and Waste Measures		**Status of Measure/ Board Consideration Date**
RW-1	Landfill Methane Control Measure	June 2009 (early action item)

Recycling and Waste Measures		**Status of Measure/ Board Consideration Date**
RW-2	Increasing the Efficiency of Landfill Methane Capture	Ongoing
RW-3: Sub strategy 1	Mandatory Commercial Recycling	Adopted by CalRecycle January 2012
RW-3: Sub strategy 2	Increase Production and Markets for Compost and Other Organics	Ongoing
RW-3: Sub strategy 3	Anaerobic/Aerobic Digestion	Ongoing
RW-3: Sub strategy 4	Extended Producer Responsibility (EPR)	Ongoing
RW-3: Sub strategy 5	Environmentally Preferable Purchasing (EPP)	Ongoing

ARB and CalRecycle have prepared six technical papers, which are the basis for the information summarized in this section. The papers are: Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; Biomass Conversion; Municipal Solid Waste Thermal Technologies; Landfilling of Waste; and State Procurement. ARB and CalRecycle also developed a Waste Management Sector Plan in consultation with affected agencies and stakeholders. The Waste Management Sector Plan identifies an integrated vision for California for addressing waste-related issues, future GHG emission reductions, and the waste reduction goals outlined in AB 341 (Chesbro, Chapter 476, Statutes of 2011). The Plan and the technical papers are included in Appendix C and at http://www.arb.ca.gov/cc/waste/waste.htm.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-1: Landfill Methane Control Measure

Background

In the initial Scoping Plan, methane emissions from landfills were identified as an early action item. Subsequently, the Board approved the Landfill Methane Control Measure in 2009. The measure requires the installation of a gas collection and control system at certain municipal solid waste (MSW) landfills. The measure contains performance standards for the gas collection and control system and specifies monitoring and maintenance requirements to ensure that the system is being maintained and operated in a manner to minimize methane emissions.

Existing federal and local requirements for MSW landfills are primarily focused on reducing volatile organic compounds and non-methane organic compound emissions from larger landfills, and not methane. This measure differs from existing federal and local requirements in that it also applies to smaller landfills and has more stringent requirements for methane collection and control. Since the requirements are more stringent, they do not conflict with or impede compliance with the existing federal or local requirements.

Status

There are about 370 landfills in California which, due to their in-place or permitted volume, waste age, and other pertinent factors, are known to have the ability to generate methane emissions. About 220 of the 370 are subject to ARB's Landfill Methane Control Measure. Most of the approximately 220 landfills have previously installed landfill gas collection and control systems due to federal and local landfill gas rules. About 20 of the 220 have submitted plans to modify their existing gas collection and control systems to meet the requirements of the landfill measure. Staff anticipates that about 14 existing uncontrolled landfills will be required to install gas collection and control systems or demonstrate that their emissions are too low to support such a system. As staff obtains further information, there may be additional landfills that may be required to install controls.

More information on the Landfill Methane Control Measure can be found at: http://www.arb.ca.gov/cc/landfills/landfills.htm.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-2: Increasing the Efficiency of Landfill Methane Capture

Background

Methane is produced when organic materials placed in landfills decompose over time. Although methane is currently captured at many large landfill sites, there are still active landfill operations and closed landfill sites that continue to emit methane that could be captured.

Additional actions that could be taken to reduce GHG emissions above and beyond those in the Landfill Methane Control Measure are being evaluated. Implementation of "best management practices (BMPs)" for landfills may provide even greater reductions of GHG emissions from landfills. Such actions may include: specific requirements for gas collection system design, construction, timing, and operation; landfill unit and cell design and construction; waste placement methods; daily and intermediate cover materials and practices; use of compost or other biologically active materials in cover soils; and organic materials management. Phasing organics out of landfills, and including landfills in the Cap-and-Trade Regulation are also being considered

Status

ARB staff is working with CalRecycle staff to investigate what regulatory actions may be taken to further reduce GHG emissions from landfills. These actions may include incorporating the BMPs identified above into the landfill methane control measure. Additional rulemaking would occur in 2015, if determined to be needed.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-3-1: Mandatory Commercial Recycling

Background

The initial Scoping Plan identified Mandatory Commercial Recycling as an important measure to meet GHG emissions and waste reduction goals. The commercial recycling measure focuses on increased commercial waste diversion. Commercial businesses in California generate roughly 75 percent of the statewide solid waste. Initially, ARB and CalRecycle worked together to develop a Mandatory Commercial Recycling regulation to be adopted by ARB. Prior to Board action, the Legislature passed AB 341 which provided CalRecycle the direction and authority to adopt a Mandatory Commercial Recycling regulation and set additional waste diversion goals.

Status

The regulation was adopted by CalRecycle in January 2012 and became effective May 2012. The regulation reflects the statutory provisions of AB 341 and provides additional procedural clarifications. The regulation has requirements for both local governments and businesses. The jurisdictions must implement an education, outreach, and monitoring program that is appropriate for that jurisdiction and is designed to divert commercial solid waste from businesses. A business (includes public entities) that generates four cubic yards or more of commercial solid waste per week or is a multifamily residential dwelling of five units or more must arrange for recycling services.

CalRecycle will conduct statewide waste characterization studies in 2014/15 and 2019 to measure the effectiveness of the regulation.

More information on the Mandatory Commercial Recycling measure can be found at: http://www.calrecycle.ca.gov/recycle/commercial/.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-3-2: Increase Production and Markets for Compost and Other Organics

Background

CalRecycle continues efforts to shift organic materials from landfills by increasing the production of and markets for compost, mulch, and biofuels/energy. Organic materials diversion from landfill disposal can provide significant GHG emission reductions primarily (but not only) through avoided landfill methane emissions. CalRecycle's

efforts to increase the production and markets for compost include compost-based best management practices; compost specifications for agriculture; and research covering a range of composting uses. Ongoing CalRecycle research will help clarify GHG emissions from compost production and compost use in agriculture, including compost impacts on agricultural N_2O emissions. As noted in the Waste Sector Plan, ARB and CalRecycle are working to identify opportunities and potential solutions for capturing organic materials for use in composting and anaerobic digestion processes.

Status

CalRecycle has completed several research projects related to compost production and markets, and has initiated several others. Completed projects include: compost-based best management practices in a field demonstration setting, and ozone-formation potential from green waste composting VOC emissions with consideration of potential BMPs to reduce ozone production. In conjunction with the San Joaquin Valley Air Pollution Control District and several stakeholders, CalRecycle completed a research project on a photovoltaic-powered aerated static pile compost system which found a 70 percent reduction in GHG emissions relative to open windrow composting. In 2010, CalRecycle published its 'Third Assessment of California's Compost and Mulch Producing Infrastructure' and is currently reviewing its composting regulations. Ongoing projects include research on the GHG emissions from compost production and GHG emission reductions from finished compost use on agricultural lands. Planned research includes a study quantifying potential air and water quality impacts from the direct application of uncomposted green wastes to agricultural lands. ARB and CalRecycle staff will continue to evaluate market strategy for end products as part of the Waste Sector Plan.

More information on the diversion of organics and composting can be found at: http://www.calrecycle.ca.gov/Climate/Organics/default.htm.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-3-3: Anaerobic and Aerobic Digestion

Background

Anaerobic digestion facilities utilize organic wastes as a feedstock from which to produce biogas (which is captured), and digestate, which is the liquid or solid material remaining after the digestion process. The methane in the biogas can be used directly as fuel or converted to other forms of energy, such as liquefied natural gas and compressed natural gas. In an aerobic system, such as composting and waste water treatment, the microorganisms access free, gaseous oxygen directly from the surrounding atmosphere. The end products of an aerobic process are primarily carbon

dioxide, water, and methane. This evaluation addresses potential actions that would promote the use of anaerobic and aerobic digestion in the State. CalRecycle policy is to encourage the development of anaerobic digestion facilities in California as an alternative to the landfill disposal of organic solid waste.

Status

One of the six technical papers developed for the Waste Sector Plan focuses on Composting and Anaerobic Digestion and identifies opportunities and challenges for waste and GHG emission reductions (see Appendix C). To better understand the role anaerobic digestion and aerobic digestion can play in meeting our GHG and waste reduction goals, staffs are reviewing research opportunities to gather data to identify how best these waste reduction options can be utilized in the future. Included in this is the development of emission reduction factors that include avoided landfill emissions. These factors will address anaerobic and aerobic digestion and composting, as well as biomass conversion and municipal waste landfill thermal technologies. The Low Carbon Fuel Standard (LCFS) program has certified a pathway for biomethane produced from the high solids anaerobic digestion of organic materials. LCFS staff is currently preparing another pathway for biomethane from the low-solids anaerobic digestion of wastewater sludge. Offset protocols for anaerobic digestion and composting are also being evaluated as a possible incentive for alternatives to landfilling. In addition, CalRecycle staff have prepared and published several reports and guidance documents to further advance anaerobic digestion technologies, including a Programmatic Environmental Impact Report (EIR) for anaerobic digestion facilities; Anaerobic Digestion Guidance document for conducting CEQA review; and a report assessing the capabilities of a new landfill-based in-situ anaerobic digester technology. CalRecycle also has assisted CEC in implementation of its AB 118 Alternative Transportation Fuels Program, which has resulted in funding of six anaerobic digestion projects. ARB is pursuing a test program with University of California, Davis and the Gas Technology Institute to add to the limited existing data on the constituents in biomethane from California sources of renewable natural gas such as the anaerobic digestion technologies (e.g. food waste). ARB and CalRecycle are also following closely the development and benefits of emerging aerobic digestion technologies and will evaluate incentive funding mechanisms to promote these technologies and infrastructure expansion.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-3-4: Extended Producer Responsibility

Background

Extended Producer Responsibility (EPR), also known as Product Stewardship, is a strategy to place a shared responsibility for end-of-life product management on the producers, and all entities involved in the product chain, instead of the general public, while encouraging product design changes that minimize a negative impact on human health and the environment at every stage of the product's lifecycle. It places primary

responsibility on the producer, or brand owner, who makes design and marketing decisions. It also creates a setting for markets to emerge that reflect the environmental impacts of a product, and to which producers and consumers respond. EPR is a waste reduction strategy. By shifting costs and responsibilities of product disposal to producers and others who directly benefit, EPR provides an incentive to eliminate waste and pollution through product design changes. Carpet and paint are two product categories where potential GHG emission reductions are targeted and stewardship programs have been established. Assembly Bill 1343, the Paint Recovery Act, and AB 2398, the Product Stewardship for Carpet Bill, were signed into law in 2010. In addition, California was the third state to introduce an industry-run statewide mattress recycling program with the passage of SB 254, the California Used Mattress Recovery and Recycling Act, in 2013.

Status

CalRecycle is implementing the requirements of the statewide Paint Stewardship Program established by AB 1343, which requires a manufacturer or designated stewardship organization to submit an architectural paint stewardship plan to CalRecycle by April 1, 2012. PaintCare, the paint stewardship organization, submitted the Architectural Paint Stewardship Program Plan to CalRecycle in 2012, (see http://www.calrecycle.ca.gov/Paint/Plans/Paintcare/June4.pdf). CalRecycle posts a list of compliant paint manufacturers and brands operating or covered under an approved paint stewardship plan at http://www.calrecycle.ca.gov/Paint/ManuBrands/default.htm. Annual update reports from PaintCare began in October 2013.

Currently, more than 1.3 million tons of carpet is landfilled annually. AB 2398, which will increase recycling of carpet, requires a carpet producer or stewardship organization to submit a carpet stewardship plan to CalRecycle with specified elements, including a funding mechanism. The mechanism must provide sufficient funds to carry out the plan, including administrative, operational, and capital costs of the plan. The California Carpet Stewardship Plan can be found at http://www.calrecycle.ca.gov/Carpet/Plans/CARE.pdf.

CalRecycle, working with the International Sleep Products Association, is developing regulations to implement SB 254. The Association is the mattress stewardship organization designing the EPR program for end-of-use management of used mattresses.

To better understand the full GHG emission reduction potential, ARB and CalRecycle staff are examining the need to develop emission reduction factors for carpet and other materials as appropriate.

More information on Extended Producer Responsibility can be found at: http://www.calrecycle.ca.gov/EPR.

Recycling and Waste Management Sector - Measures Identified in the Scoping Plan

RW-3-5: Environmentally Preferable Purchasing

Background

Environmentally Preferable Purchasing (EPP) is the procurement of goods and services that have a reduced impact on human health and the environment compared to competing products serving the same purpose. To reduce the quantity and toxicity of waste in California, State law requires State agencies and other public entities to purchase environmentally preferable products that consider a range of attributes, including if the product is repairable, durable, made with recycled content, and can be recycled again. As part of the initial Scoping Plan, one area to be investigated was the potential development of EPP specifications, contracts and guidelines to promote the use of commodities that lower energy use, increase recycling and reuse and reduce the emissions of greenhouse gasses.

Status

As part of ARB's Waste Sector Plan, staff developed a technical report to identify opportunities for reducing waste generated, purchasing recycled material, increasing reuse, and enhancing end of life responsibility. ARB and CalRecycle are working with DGS to identify options of increasing EPP opportunities. This may lead to meetings with other state agencies not under direct DGS authority for education about EPP benefits of using recycled and remanufactured goods.

More information on Environmentally Preferable Purchasing can be found at: http://www.calrecycle.ca.gov/EPP/, and the State Procurement technical paper in Appendix C.

H. Forests Sector

The status of the forest measure in the initial Scoping Plan is summarized in Table 7 below.

Table 7: Status of Forest Sector Measures

Forest Measure		Status of Measure
F-1	Sustainable Forest Target	Ongoing

Forests Sector - Measures Identified in the Scoping Plan

F-1: Sustainable Forest Target

Background

The initial Scoping Plan included a Sustainable Forest Target. The goal of this target was to maintain net forest sequestration. This was to be achieved using the mechanisms provided by the Forest Practice Rules, timberland conversion regulations, fire safety requirements, forest improvement assistance programs, as well as the California Environmental Quality Act (CEQA), which requires avoidance or mitigation of forest carbon losses to conversion. The initial Scoping Plan also identified other opportunities to realize additional GHG emission reductions and increased sequestration, including:

- Preventing the conversion of forestlands through publicly and privately funded land acquisitions;
- Maintaining and enhancing forest stocks on timberlands through forest management practices subject to the Forest Practice Act;
- Planting trees on lands that were historically covered with native forests;
- Establishing forest areas where the preceding vegetation was not forest;
- Planting trees in urban areas;
- Using urban forest wood waste for bioenergy; and
- Reducing vegetative fuels that could feed wildfires and using this waste for bioenergy.

Status

The Board of Forestry and Fire Protection (BoF) has been evaluating the adequacy of existing forest regulations and programs for achieving GHG emission reductions and ensuring carbon sequestration in the forest sector. In 2010, amendments to CEQA guidelines led to the requirement that timber harvest proponents subject to State regulations must analyze GHG emissions when applying for CAL FIRE permits.

There has been significant work on the GHG emissions inventory for forests since the initial Scoping Plan. In 2011, ARB contracted with researchers from the University of California (UC) Berkeley, to improve the current GHG emission inventory estimates of forest carbon stocks and emissions. Researchers are using a carbon stock change approach based on field measurements (Forest Inventory and Analysis data) and remote sensing methods. The inventory has also been expanded to include additional land types including grasslands, scrublands, and wetlands. Preliminary results from the research suggest that these natural and working lands are likely a significant source of GHG emissions rather than a net carbon sink. Specifically, the results indicate that emissions from wildfires, land use conversion, management practices, and other sources may significantly outweigh the current carbon uptake ability in this sector, as currently managed. This would make it vitally important to quickly and aggressively take steps to reverse this trend.

CAL FIRE, in conjunction with the U.S. Forest Service and researchers at UC Davis are also developing GHG inventory data for urban forests and are continuing to refine and update those data over time. Improvements to ongoing GHG reporting systems will include refinements to methods and incorporating additional relevant data sets (such as information on vegetation, forest stand treatments, and other activities) that are collected by CAL FIRE and other agencies.

On September 11, 2012, Governor Brown signed Assembly Bill 1492 (AB 1492; Blumenfield, Chapter 289, Statutes of 2012), with the first major changes in forest sector legislation in 10 years. Among other things, AB 1492 set into motion a fee on certain types of lumber and wood products in California that now help fund forest management programs related to timberlands.

I. High Global Warming Potential (High GWP) Gases Sector

The status of each High GWP measure in the initial Scoping Plan is summarized in Table 8 below.

Table 8: High Global Warming Potential Gases Measures

High GWP Gases Measures		Status of Measure/Board Consideration Dates
H-1	Motor Vehicle Air-Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing	January 2009 (early action item)
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications	February 2009 (early action item)
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing	February 2009 (early action item)
H-4	Limit Use of Compounds with High Global Warming Potentials in Consumer Products	June 2008 (early action item)
H-5	1. Low Global Warming Potential Refrigerants for New Motor Vehicle Air-Conditioning Systems	Part of Advanced Clean Cars program
	2. Air Conditioner Refrigerant Leak Test During Vehicle Smog Check	Measure not feasible at this time
	3. Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers	Measure not feasible at this time
	4. Enforcement of Federal Ban on Refrigerant Release During Servicing or Dismantling of Motor Vehicle Air-Conditioning Systems	Measure not feasible at this time

High GWP Gases Measures		Status of Measure/Board Consideration Dates
H-6	1. Stationary Equipment Refrigerant Management Program – Refrigerant Tracking/Reporting/Repair Program	December 2009 (early action item)
	2. Stationary Equipment Refrigerant Management Program – Specifications for Commercial and Industrial Refrigeration	Energy conservation measures and leak-tight design and installation standards for supermarket refrigeration added to Title 24 Building Code January 2014
	3. Foam Recovery and Destruction Program	Measure not feasible at this time
	4. SF_6 Leak Reduction Gas Insulated Switchgear	February 2010
	5. Alternative Suppressants in Fire Protection Systems	Measure not feasible at this time
	6. Residential Refrigeration Early Retirement Program	Measure not feasible at this time
H-7	Mitigation Fee on High-GWP Gases	Under evaluation

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-1: Automotive Refrigerant Regulation

Background

The Board approved the Mobile Air Conditioning regulation in January 2009. Automotive refrigerants are highly potent GHGs, and the most commonly used automotive refrigerant is HFC-134a, with a GWP of 1,300. The regulation helps prevent unnecessary releases of refrigerants to the atmosphere and applies to automotive refrigerants with a GWP value greater than 150. It applies to the sale, use, and disposal of containers holding more than two ounces and less than two pounds of refrigerant by weight. The regulation achieves emission reductions through implementation of four requirements:

- Use of a self-sealing valve on the container.
- Improved labeling instructions.
- A deposit and recycling program for small containers.
- An education program that emphasizes best practices for vehicle recharging.

In addition, the regulation requires the recycling of container materials along with the refrigerant remaining in the used containers.

Status

The regulation became effective on January 1, 2010. Implementation began with a one-year sell-through period for uncertified products manufactured prior to January 2010. Product certification was initiated in 2009 and is on-going. Currently, two manufacturers have 26 products certified for sale in California. Additional products are being certified and it is anticipated that more manufacturers will apply for certification. Manufacturers, distributors, and retailers submitted annual reports for 2010 to 2012 to ARB. Staff is currently evaluating the reports.

Staff conducted outreach to manufacturers, associations, and regulated parties. ARB's website includes the regulation, fact sheets, executive orders for certified products, and report forms. In addition, as part of product certification, manufacturers are required to develop educational materials for use by consumers of automotive refrigerant products. This includes web pages with information and brochures that retailers can make available at the point of sale.

More information on the Mobile Air Conditioning Regulation can be found at: http://www.arb.ca.gov/cc/hfc-mac/hfcdiy/hfcdiy.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-2: Sulfur Hexafluoride Limits in Non-Utility and Non- Semiconductor Applications

Background

The Board approved the Regulation for Reducing Sulfur Hexafluoride Emissions in February 2009. This regulation aims to reduce sulfur hexafluoride (SF6) emissions from non-electric and non-semiconductor applications including tracer gas testing, magnesium sand casting, magnesium investment casting, and other niche uses through a phase-out over several years. The regulation applies to any individual who buys, uses, or sells SF6 with a limited number of exemptions. It also includes a phase-in period for particular uses to allow for the identification of cost-effective alternatives that may need to be tested and proven effective and usable.

Status

The regulation became effective on January 1, 2010. Restrictions on use and sale began January 1, 2011. Distributor and research user registration, reporting, and recordkeeping requirements became effective March 30, 2010. ARB staff is currently compiling sales data reported in distributor annual reports, and assisting magnesium casters to identify and implement the use of alternative cover gases.

More information on the Sulfur Hexafluoride Emissions in Non-Semiconductor and Non -Utility Applications Regulation can be found at: http://www.arb.ca.gov/cc/sf6nonelec/sf6nonelec.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-3: Reduction of Perfluorocarbons in Semiconductor Manufacturing

Background

The Board approved the Semiconductor Operations Regulation in February 2009. This regulation applies to owners or operators of a semiconductor or related devices operation that uses fluorinated gases or heat transfer fluids. This includes, but is not limited to, the processing of diodes, zeners, stacks, rectifiers, integrated microcircuits, transistors, solar cells, light-sensing devices, and light-emitting devices. The regulation includes emission standards, and reporting and recordkeeping requirements. Semiconductor operations that emit more than 0.0008 MMTCO2E per calendar year are subject to the emission standards. The emission standards are tiered, and vary depending on the quantity of wafers (thin semiconductor material from which integrated circuits or “chips” are made) processed at an operation.

Status

The regulation became effective on January 1, 2010. All owners and operators are subject to the reporting and recordkeeping requirements of the regulation. The regulation required owners and operators to submit an initial emissions report to the permitting agency (local air district) no later than March 1, 2011. This report quantified the monthly and annual carbon dioxide equivalent emissions from semiconductor operations conducted during the 2010 calendar year. Thereafter, owners and operators must submit an annual report by March 1st of each calendar year that quantifies emissions occurring in the previous calendar year.

All owners and operators are required to maintain records on quantities of fluorinated gases and heat transfer fluids purchased or delivered, as well as records of emission control equipment malfunctions and failures. All records must be maintained at the facility and be readily accessible for inspection for at least three years.

ARB staff continues to work with local air districts to gather annual emissions data. ARB staff aggregates and analyzes data gathered to determine implementation status and update emission inventories.

Staff developed the Semiconductor Emissions Estimate Calculator to help owners and operators benchmark and calculate their GHG emissions from semiconductor operations. Staff also developed the Semiconductor Operations Reporting Form to simplify reporting for industry, promote consistency in reports, and lessen the review time for air district personnel.

More information on the Semiconductor Operations Regulation can be found at: http://www.arb.ca.gov/cc/semiconductors/semiconductors.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-4: Limit High Global Warming Potential Use in Consumer Products

Background

In June 2008, September 2009, and November 2010, the Board approved amendments to the California Consumer Products Regulation. The amendments prohibit the use of compounds with GWP values of 150 or greater in specified consumer product categories including double phase aerosol air freshener, flying bug insecticide, furniture maintenance product, several types of lubricant, metal polish or cleanser, multi-purpose solvent, paint thinner, pressurized gas duster, spot remover, and wasp or hornet insecticide. The regulation applies to any person who sells, supplies, or offers for sale (e.g., manufactures and distributors) regulated consumer products in California. The GWP limits for the other consumer products will not achieve additional reductions but will prevent the introduction of products containing high GWP GHGs.

Status

The GWP limit for Pressurized Gas Dusters required products using HFC-134a to reformulate with HFC-152a, and went into effect on December 31, 2010. The sell-through period for remaining high GWP GHG containing Pressurized Gas Duster products ended December 31, 2011.

More information on the California Consumer Products Regulation can be found at: http://www.arb.ca.gov/consprod/regact/ghgcp/ghgcp.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-5-1: Low Global Warming Potential Refrigerants for New Motor Vehicle Air Conditioning Systems

Background

This measure incentivizes auto manufacturers to use low-GWP refrigerants in new motor vehicle air conditioning (MVAC) systems.

Previous California regulations (Pavley and Environmental Performance Label) relied on a credit system to encourage auto manufacturers to use low-GWP refrigerants in new vehicles and to improve the leak-tightness of new systems that utilize the current high-GWP refrigerant, HFC-134a. The credit system also encourages auto manufacturers to reduce indirect CO_2 emissions from fuel consumption to run the MVAC systems through a number of proven technologies. The U.S. EPA adopted a similar credit system approach for a national program that has become effective from model year 2012 through model year 2016.

The current measure is part of the Low Emission Vehicle (LEV III) regulation. The measure uses a more refined credit system as compared with the one in the Pavley and Environmental Performance Label regulations to continue encouraging auto manufacturers to use low-GWP refrigerants in new MVAC systems. The credit system

also encourages the improvement of leak-tightness of the systems, regardless of the type of the refrigerant, and the reduction of indirect CO_2 emissions.

Status

The previous MVAC credit system covering model years 2009 through 2016 is part of the Pavley regulation, which was approved in September 2004. It has been adopted (with modification) into a federal program covering model years 2012-2016. The new measure covering model years 2017 through 2025 is part of the LEV III regulation under the Advanced Clean Cars program, which was approved by the Board in January 2012. It is aligned with a new federal program covering model years 2017-2025.

More information on the Low Global Warming Potential Refrigerants for New Motor Vehicle Air Conditioning Systems measure can be found at: http://www.arb.ca.gov/cc/hfc-mac/mvac-gwp/mvac-gwp.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-5-2: Air Conditioner Refrigerant Leak Test during Vehicle Smog Check

Background

This measure proposed to explore the addition of a new motor vehicle air conditioning (MVAC) system leak test and repair requirement to the existing California Smog Check program for HFC-based MVAC systems. Under this proposal, all vehicles that pass Smog Check would have MVAC systems that are either nearly leak-free or empty and excluded from further use of the MVAC systems unless the leak is repaired. Vehicles that are determined to have unacceptable leak rates would be required to be repaired as a condition for registration. The measure required considerable cooperation with the Bureau of Automotive Repair of the Department of Consumers Affairs before mandating that a new procedure be integrated into the statewide Smog Check program.

Status

This measure was determined not to be feasible at this time. Staff determined that it would be difficult for Smog Check technicians to acquire the necessary training, certification, and equipment to perform vehicle air conditioning leak checks and repairs. Also, the benefit of the measure would be limited to older vehicles since newer air conditioning systems are tighter and use less refrigerant, and future vehicles are expected to use low GWP refrigerants.

More information on the addition of AC Leak Test and Repair Requirements to the Smog Check Program can be found at: http://www.arb.ca.gov/cc/hfc-mac/acsmogcheck/acsmogcheck.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-5-3: Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers

Background

This measure proposed to address the recovery of refrigerants from decommissioned refrigerated shipping containers. Perishable refrigerated items are the largest, most profitable, and fastest growing sector of international trade, and refrigerated shipping containers (RSCs) serve as the primary system to transport frozen and refrigerated items for the retail, pharmaceutical, and food service industries throughout the world. GHG emissions from RSCs occur during various stages including leakage of refrigerant during decommissioning, leakage of refrigerant during normal use and indirect CO_2 emissions from diesel engines.

Status

This measure was determined not to be feasible at this time. Staff found the emission reductions to be relatively small, and that multiple participants in the cold chain used and decommissioned RSCs making it difficult to implement the measure.

More information on the Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers measure can be found at: http://www.arb.ca.gov/cc/hfc-mac/rsc-ghg/rsc-ghg.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-5-4: Enforcement of Federal Ban on Refrigerant Release During Dismantling of Motor Vehicle Air Conditioning Systems

Background

This measure proposed to enforce the federal ban on refrigerant release during servicing or dismantling of motor vehicle air conditioning systems. The goal of this non-regulatory strategy was to improve compliance with a regulation of U.S. EPA (40 CFR 82.154) that prohibits the venting of certain types of refrigerant, including HFCs, to the atmosphere when MVAC equipment is serviced or dismantled. Venting is avoided by recovering refrigerants with specialized equipment.

Status

This measure was determined not to be feasible at this time. Staff found the estimated emission benefits of this measure to be relatively small. Also, the benefit of the measure would be limited to older vehicles since newer air conditioning systems use less refrigerant and future vehicles are expected to use low-GWP refrigerants.

More information on the Enforcement of Federal Ban on Refrigerant Release During Dismantling of Motor Vehicle Air Conditioning Systems can be found at: http://www.arb.ca.gov/cc/hfc-mac/mvac-dismant/mvac-dismant.htm

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-1: High Global Warming Potential Refrigerant Management Program

Background

The Board approved the Stationary Equipment Refrigerant Management Program in December 2009. This regulation reduces emissions of high GWP refrigerants resulting from the installation, use, servicing, and dismantling of larger refrigeration systems. The Refrigerant Management Program regulation requires facilities with refrigeration systems with more than 50 pounds of high-GWP refrigerant to conduct periodic leak inspections, promptly repair leaks, and keep service records on site; additionally, such facilities must register their systems and submit annual refrigerant use reports. The regulation also applies to any person who installs, services, or disposes of any appliance that utilizes a high-GWP refrigerant, as well as refrigerant wholesalers, distributors, and reclaimers.

Status

The regulation became effective on January 1, 2011, and the measure implementation is currently on track. The regulation includes a phased in registration, reporting and annual implementation fee approach depending on the size of the refrigeration system used at the facility. Facilities with large refrigeration systems with 2,000 pounds or more of high-GWP refrigerant began registration and reporting in 2012. Facilities with medium refrigeration systems with 200 pounds or more, but less than 2,000 pounds, of a high-GWP refrigerant are required to register and report beginning in 2014. Staff continues to conduct comprehensive outreach and implementation activities to increase compliance with the regulation.

More information on the Refrigerant Management Program can be found at: http://www.arb.ca.gov/StopRefrigerantLeaks.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-2: Commercial Refrigeration Specifications

Background

This measure proposes to reduce both direct and indirect GHG emissions from large supermarket refrigeration systems. Direct emission reductions of high GWP refrigerants would occur from the improved design, installation and use of such systems, while indirect emissions reductions would result from energy conservation measures applied to the systems.

Due to high cost, feasibility issues and probable energy penalties associated with the initial requirement to use secondary cooling loops or alternative refrigerant systems in supermarkets, the proposed measure had to be significantly revised. The revised measure includes design and installation standards as well as energy conservation measures for new supermarket refrigeration systems. Staff developed these measures in close collaboration with CEC (primary agency for energy efficiency measures) and CBSC (primary agency for green building standards).

Status

CEC adopted the energy conservation measures in 2012, which have become part of the 2013 Title 24 Building Energy Efficiency Standards to go into effect July 1, 2014. In 2013, CBSC adopted the design and installation standards into the 2013 Title 24 Green Building Standards that went into effect January 1, 2014. CEC is now the lead agency for the energy conservation measures.

More information on the Commercial Refrigeration program can be found at: http://www.arb.ca.gov/cc/commref/commref.htm

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-3: Foam Recovery and Destruction Program

Background

This measure would mitigate high GWP greenhouse gas emissions from waste insulation foam used in refrigerators, freezers, and buildings. Insulating foams with high-GWP GHGs include rigid poly foams made from polyurethane, polyisocyanurate, and extruded polystyrene board stock and panels (fiberglass insulation does not contain GHGs and was not included in this measure). The foam recovery and destruction program was proposed to further study and assess the feasibility of reducing GHG emissions from waste insulation foam. The measure required the collection of insulating foam and the subsequent recycling or destruction of high GWP gases.

Status

Staff determined that the measure was not feasible at this time due to cost effectiveness. Additionally, based on the biological attenuation of foam in landfills and the capture and combustion of GHGs by landfill gas collection systems, the assumed emissions from landfilled waste foam are not as great as originally estimated in 2008. In June 2012, ARB awarded a research contract to investigate and measure GHG emissions from waste foam, and results are expected in 2015. The measure may be revisited based on the research findings.

More information on the Foam Recovery and Destruction Program can be found at: http://www.arb.ca.gov/cc/foam/foam.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-4: Sulfur Hexafluoride from Gas Insulated Switchgear

Background

This measure achieves GHG emission reductions by reducing SF6 emissions from Gas Insulated Switchgear (GIS).

The Regulation requires GIS owners to reduce their SF6 emission rate by one percent per year over a ten year period, from 2011 to 2020. The initial maximum annual emission rate is set at 10 percent of a GIS owner's nameplate capacity of non-hermetically sealed GIS. The annual emission rate decreases one percent per year until 2020. Beginning January 1, 2020, the maximum annual emission rate is set at one percent. The measure also requires GIS owners to: (1) annually report their SF6 emissions; (2) report the emission rate; (3) provide a complete inventory of all gas insulated switchgear and their SF6 capacities; (4) produce a SF6 gas container inventory; and (5) keep all information current for ARB enforcement staff inspection and verification.

Status

By June 1, 2012, and June 1st of each year thereafter, each GIS owner must submit an annual report to the Executive Officer for emissions that occurred during the previous calendar year. The first two required annual reporting years (2011 and 2012) for this measure have been completed.

More information on the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear can be found at: http:/www.arb.ca.gov/cc/sf6elec/sf6elec.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-5: Alternative Suppressants in Fire Protection Systems

Background

This measure would require the use of leakage reduction methods and/or lower GWP fire suppression agents, to the extent that safe, technically feasible, and cost-effective alternatives are available.

Status

This measure was determined to be not currently feasible due to low emissions reductions, which are expected to further decline.

More information on the Alternative Suppressants for Fire Protection System can be found at: http://www.arb.ca.gov/cc/altsup/altsup.htm.

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-6-6: Residential Refrigeration Early Retirement Program

Background

Under this measure, ARB would work with utilities to encourage and incentivize recovery of high-GWP materials from residential refrigerators at end-of-life.

Status

This measure was determined not to be feasible at this time. Foam recovery for 15 percent of the state's appliances is subsidized through the electric utility public goods charge to implement energy-saving programs, including early retirement of older appliances. The current public goods charge is insufficient to expand existing program.

More information on the Residential Refrigeration Early Retirement can be found at: http://www.arb.ca.gov/cc/residref/residref.htm

High Global Warming Potential Gases Sector - Measures Identified in the Scoping Plan

H-7: Mitigation Fee on High GWP Gases

Background

This measure proposed establishment of an upstream fee on high GWP gases based on their global warming potential.

Status

The measure is currently under evaluation for feasibility and cost-effectiveness.

I. Agriculture Sector

The status of the agriculture measure in the initial Scoping Plan is summarized in Table 9 below.

Table 9: Status of Agriculture Measure

Agriculture Measure		Status of Measure
A-1	Methane Capture at Large Dairies	Under evaluation

Agriculture Sector - Measures Identified in the Scoping Plan

A-1: Methane Capture at Large Dairies Utilizing Anaerobic Digestion

Background

The installation of manure digesters to reduce methane emissions was included as a voluntary strategy for the agricultural sector in the initial Scoping Plan.

Status

The voluntary installation of anaerobic digesters at dairies in California has not increased as expected. This is due to the recent economic recession, increased feed and fuel prices, lack of sufficient financial incentives, and insufficient utility contracts. ARB is working with federal, state, and local agencies, as well as industry stakeholders, to remove obstacles to digester installations. Critical to this is the continued effort to evaluate the many co-benefits of manure management through digesters. The evaluation will examine the potential for successful voluntary efforts to be more widely adopted in the State. As new information becomes available, ARB will work with stakeholders to determine whether and how the program should become mandatory and/or more strongly incentivized.

The initial Scoping Plan also called for research on baseline nitrous oxide (N_2O) emissions from the use of fertilizers to improve the GHG inventory. ARB, CEC, and the California Department of Food and Agriculture (CDFA) have been coordinating and funding research to determine baseline N_2O emissions from a variety of soil types, crops, and farming techniques used throughout California. Research began in 2009 and is expected to be completed by the end of 2014.

A number of other potential voluntary GHG-reduction activities were mentioned in the initial Scoping Plan, including improving agriculture water use efficiency, increasing the efficiency of or electrifying agricultural water pumps, using biomass-based fuels, and increasing carbon sequestration on agricultural lands.

CDFA, in partnership with scientists at UC Davis and with funding from CEC, are evaluating the economic, beneficial environmental factors, and costs of biofuel feedstock crops. Outcomes will focus on cropping systems for California with best management practice recommendations; estimates of direct environmental costs such as water use, input levels, and effects; and potential off-farm environmental consequences. CDFA is working with ARB to expand use of biomass-based transportation fuels as a regulatory pathway under the Low Carbon Fuel Standard.

CDFA is also supporting projects that address GHG mitigation through its Specialty Crop Block Grant Program (SCBGP). Results of funded research projects provide knowledge and tools to help growers reduce GHG emissions and increase carbon sequestration.

Appendix C - Focus Group Working Papers

Electricity and Natural Gas Working Paper

Section 1: Introduction

In California, the energy sector contributes about 85 percent of the greenhouse gases (GHG) emitted on a yearly basis and roughly 40 percent comes from the electricity and natural gas systems and the remainder from transportation services and fuel infrastructure.[1] Reducing GHG emissions 80 percent below 1990 levels by 2050 will require nothing less than a complete transformation of the energy system. Since transportation is covered separately, this paper focuses on the electricity and natural gas systems and only references transportation in terms of how it directly impacts the electricity or natural gas systems. To position California to achieve the 2050 vision, innovation and unprecedented advancements are needed in:

- Energy efficiency in existing buildings, new buildings, and appliances. Key state actors are: California Energy Commission (Energy Commission), California Public Utilities Commission (CPUC), and Governor's Office.
- Demand response so that it can be an effective tool to help reduce energy demand and provide a zero-GHG mechanism for matching variable supply and demand. Key state actors are: Energy Commission, CPUC, and California Independent System Operator (California ISO).
- Combined heat and power (CHP) as a tool to reduce energy demand and provide distributed generation (DG) for use on-site. Key state actors are: Energy Commission, CPUC, California ISO, and the California Air Resources Board (ARB).
- Renewable energy to displace electricity generated from fossil fuels. Key state actors include: CPUC, California ISO, Energy Commission, and Governor's Office.
- Renewable DG to develop localized energy sources that do not create GHGs. Key state agencies include: Energy Commission, CPUC, California ISO, local governments, and Governor's Office.
- Energy storage, smart grid, demand response, and forecasting to maintain grid reliability while integrating increasing amounts of variable renewable resources into the electricity system. Key state actors are: Energy Commission, CPUC, and California ISO.
- Bioenergy to displace electricity generated from fossil fuels. Key state agencies include: Natural Resources Agency, Energy Commission, Department of Forestry and Fire Protection, CPUC, California Department of Food and Agriculture, ARB, CalRecycle, and California Environmental Protection Agency.

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[1] Energy Commission staff analysis. Data accessed on 06/07/2013 from http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-10_2013-02-19.pdf (Scoping Plan Category) and http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_ipcc_00-10_all_2013-02-19.pdf (IPCC Category).

- Carbon capture, utilization, and storage (CCUS) coupled with some natural gas fired electricity to help manage the variability in supply and demand and maintain the reliability of the electricity system. Key state agencies are: Energy Commission, CPUC, and California Department of Conservation, Division of Oil Gas and Geothermal.
- Solar for space and water heating to reduce natural gas consumption as an alternative to electrification of the residential and industrial sectors. Key state agencies are: Energy Commission and CPUC.
- Research, development and demonstration (RD&D) in each sector noted above to achieve advancements and breakthroughs in technology and systems planning. Also, RD&D is needed, to better understand how climate change will affect energy systems and what changes can make the energy sector more resilient to climate change. Key state agencies: Energy Commission, CPUC, and the California Natural Resources Agency.

Recognizing the uncertainty surrounding technological and economic changes over the next several decades, this working paper proposes pursuing a set of GHG emission reduction strategies, where each strategy will help ratchet down emissions. This provides a diversified portfolio of actions to help California manage uncertainty and reduce risk related to GHG emission reductions.

Also, the state's "loading order" policy provides guiding principles by prioritizing energy efficiency, and demand response as the state's preferred means of meeting growing energy needs, followed by renewable resources, and DG, and then clean and efficient fossil-fueled generation. The loading order also calls for improvements in the transmission and distribution systems.

The state cannot achieve the needed GHG emission reductions by simply building from current trends and no single party can transform the energy sector. The state will play an important role to help facilitate meeting the 2050 goal, including setting policies, establishing market rules, implementing programs, and, perhaps most importantly, advancing needed RD&D. Strong partnerships with the federal and local government, utilities, industry, environmental groups, environmental justice organizations, universities, national laboratories, and others are also needed to help spur and deploy innovation.

This working paper is organized as follows:

- **Section 2** provides an update on energy programs that have helped reduce GHG emissions in California since 2008 and describes the climate change impacts on California's electricity and natural gas sectors.
- **Section 3** puts forward a vision for California's electricity and natural gas systems both mid-term and long-term to meet the GHG reduction goal, identifies the major barriers to achieving the vision, and recommends solutions.
- **Section 4** summarizes the priority recommendations set forth in this working paper to achieve the vision outlined in Section 3.

- **Section 5** ties together critical points into a conclusion.

Section 2: GHG Reductions and Climate Change Impacts

The 2008 AB 32 *Scoping Plan* laid out a pathway to achieve almost 30 percent of the Plan's total GHG emission reductions by implementing the following measures: energy efficiency standards and programs (including goals for increasing CHP), the 33 percent Renewables Portfolio Standard (RPS), and Senate Bill 1 (SB 1, Murray, Chapter 132, Statutes of 2006). At the same time, the 2008 Scoping Plan included actions to reduce GHG emissions from the transportation sector, including electrification of ports and increased penetration of electric vehicles.

From 2004 to 2011, GHG emissions from California's electricity sector have declined annually. The electricity sector produced 120.14 million metric tons (MMT) of carbon dioxide equivalent emissions (CO_2E) in 2008 and 86.57 MMT CO_2E in 2011.[2] A portion of this drop can be attributed to temporary conditions such as fluctuations in zero-emissions hydroelectric production and reduced electricity demand because of the recession. Other emission reductions are the result of more permanent changes from the development and implementation of programs and regulations for increased energy efficiency and renewable energy.

Electricity emissions were higher in 2012 than in 2011. In both 2012 and 2013, demand levels recovered slightly. The retirement of the San Onofre Nuclear Generation Station (San Onofre) in 2013 cut in-state nuclear GHG-free generation in half. The expansion of energy efficiency, as well as solar and wind resources offset some of these effects, but the main source of incremental power has been natural gas. Such variations are to be expected on a year-to-year basis, but the long-term trend of carbon reductions will continue. Although renewable generation is increasing, emissions may increase due to several factors. These factors include: potential below average generation for hydropower in 2012 and 2013, the retirement of San Onofre by Southern California Edison (SCE) in 2013, and electricity demand growth of about 1.2 percent in 2012. Energy Commission staff is projecting an annual electricity demand growth rate of 1.15 percent over the next decade.[3] Also, the GHG benefits of increased renewable energy will vary depending on how well generation matches demand and the extent to which gas-fired electricity generation is needed.

In the natural gas sector, gas end-use has been flat and use per person has been slowly dropping since the late 1990s.[4] Individual year variations and the recession caused end-uses of natural gas to decrease between 2008 and 2009, followed by a slow recovery so that 2011 natural gas end-use consumption was essentially the same

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[2]California Air Resources Board-Revised, California Greenhouse Gas Inventory for 2000-2010 – by Category as Defined in the Scoping Plan, 8-1-2013, http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-11_2013-08-01.pdf

[3] Projected consumption is projected to dip slightly in 2013 due to expected electricity rate increases and because 2012 had an unusually high number of warm days with increased cooling loads.

[4] California Energy Demand, 2012,CEC-200-2012-011cmf, p. 47.

as four years before. For the period 2000 to 2010, natural gas consumption shows a general modest declining trend. In addition to direct carbon dioxide emissions from the combustion of natural gas, the natural gas system also emits fugitive methane emissions (leaks) that increase the net emissions from this system. In 2008, the ARB Scoping Plan identified measures that "would regulate fugitive emissions from oil and gas recovery and gas transmission activities." Natural gas plays three roles in California's economy – an electricity generation source, a direct combustion fuel for end-uses including CHP, and a combustion source at oil and gas extraction and refineries.

For electricity generation, natural gas has traditionally substituted for hydropower, renewables, and nuclear resources when they were not available and in recent years it has helped integrate intermittent renewable generation such as wind and solar. The overall efficiency of the natural gas fleet continued to improve over the past decade as older units were replaced with more efficient ones.[5]

Natural gas prices have tended to be volatile around an average natural gas price that increased by almost 30 percent per year between 2000 and 2008. The most recent price spike was in 2008, but prices started to drop in 2009 and continued their descent with increased supplies from the large expansion of shale gas resources. Between 2009 and 2012, natural gas prices decreased by an average annual rate of almost 20 percent. This price reduction has led to a national shift away from coal and towards natural gas use in the electricity sector. From 2010 to 2012, GHG emissions from power generation have decreased 10 percent nationally. It has also led to lower consumer gas and electric bills than was previously estimated.

Activities that Reduce Electricity and Natural Gas Emissions Since 2008

California's energy agencies share the goal of creating an electricity sector that will provide safe, reliable, affordable, efficient, and environmentally-sustainable power while reducing GHG emissions. The energy agencies developed and implemented a suite of programs and regulations since 2008 that contributed to emission reductions, with additional reductions expected in future years.

Energy Efficiency

- The Energy Commission's building and appliance energy efficiency standards reduced electricity use by 11,828 gigawatt hours (GWh)[6] from 2008 to 2011. Building efficiency standards were updated in 2008 and 2013 for residential and non-residential buildings that are new, additions, or alterations. The 2013 standards are 25 percent more energy efficient than previous standards for

[5] California Energy Commission, *Thermal Efficiency of Gas-Fired Generation in California: 2012 Update*, http://www.energy.ca.gov/2013publications/CEC-200-2013-002/CEC-200-2013-002.pdf, p. 10.

[6] Computed from *California Energy Demand, 2012-2022 Final Forecast* , June 2012, Form 2.2 on Committed Energy Impacts.

residential construction and 30 percent better for non-residential construction.[7] Appliance standards for televisions adopted in 2009 are projected to save 6,515 GWh by 2013 after the existing television stock is replaced, and the first-in-the-nation efficiency standards for battery chargers adopted in 2012 will save nearly 2,200 GWh per year.[8, 9] In addition, the Energy Commission accelerated implementation of federal energy efficiency standards for light bulbs set by the Energy Independence & Security Act of 2007, resulting in energy and consumer savings sooner for Californians. Under the Energy Commission's American Recovery and Reinvestment Act of 2009 (ARRA) programs, three targeted commercial programs focused on the installation of heating, ventilation, and air conditioning (HVAC) and lighting controls created with technology that received Public Interest Energy Research (PIER) funding, as well as refrigeration case lighting in grocery stores statewide. A total of 3,728 targeted commercial upgrades were completed, saving 91 GWh annually.

- In September 2008, the CPUC developed its long-term Energy Efficiency Strategic Plan and implementation roadmap for the Big Bold Energy Efficiency Strategies. This Plan was later updated in January 2011 and puts forward the following goals:[10]
    - All new residential construction in California will be zero net energy (ZNE) by 2020.
    - All new commercial construction in California will be ZNE by 2030.
    - HVAC will be transformed to ensure that its energy performance is optimal for California's climate.
    - All eligible low-income customers will be given the opportunity to participate in the low income energy efficiency program by 2020.
- For the investor-owned utilities' (IOUs) 2010-2012 portfolio of energy efficiency programs, in 2009 the CPUC approved several billion dollars[11] of investments that were coupled with commercial and private business and home financing and $341 million ARRA funds. Reported (unverified) electricity savings as of December 2012 for the current program cycle were 10,406 gross annual GWhs.[12] By law, utilities are directed to achieve all cost-effective energy efficiency that is reliable and feasible.[13]

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[7] Computed from *California Energy Demand, 2012-2022 Final Forecast* , June 2012, Form 2.2 on Committed Energy Impacts.

[8] http://www.energy.ca.gov/appliances/tv_faqs.html.

[9] http://www.energy.ca.gov/releases/2013_releases/2012_Accomplishments.pdf.

[10] Detailed strategies and goals can be found at http://www.cpuc.ca.gov/NR/rdonlyres/A54B59C2-D571-440D-9477-3363726F573A/0/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf

[11] In September 2009, the CPUC issued Decision 09-09-047 approving the IOUs' 2010–2012 $3.1 billion efficiency program portfolios, a 42 percent increase in expenditures from the previous 2006–2008 program cycle.

[12] California Public Utilities Commission, http://eega.cpuc.ca.gov/.

[13] SB 1037 (Kehoe, Chapter 366, Statutes of 2005) and AB 2021 (Levine, Chapter 734, Statutes of 2006) as cited in *Achieving Cost-effective Energy Efficiency in Californi*a 2011-2020, CEC-200-2011-007-SD, pages 5 and 6

- About 25 percent of the state's electricity consumption is served by the state's publicly-owned utilities which include municipal districts, city departments, irrigation districts, and rural cooperatives. In 2012, the publicly-owned utilities spent approximately $127 million on energy efficiency and reduced their peak demand by 82.5 megawatts (MW), up 2 percent from 2011 (unverified). Publicly-owned utilities achieved 440 GWh in energy savings in fiscal year 2011/2012, down 4 percent from 2011 (unverified).
- In 2010, the Energy Commission, CPUC, utilities, local governments, non-governmental organizations, and the private sector launched Energy Upgrade California, a "whole building" approach to advance upgrades to existing buildings. The Energy Commission deployed $131.7 million in ARRA funding for the program; local governments leveraged $60 million in United States Department of Energy (U.S. DOE) grants and other leveraged funds; and California's IOUs contributed $102 million of ratepayer funds. Funding was used to develop innovative programs to upgrade commercial, multifamily, and single family buildings; conduct outreach and education; and provide homeowners with rebates of up to $4,000 for energy efficiency upgrades. From program start through the end of ARRA funding on April 30, 2012, more than 9,200 projects were completed. From May 2012 to April 2013, an additional 3,550 energy upgrade projects were completed as part of the program's continuation.
- Executive Order B-18-12[14] sets aggressive goals for improving the efficiency of state buildings including: reducing grid-based energy purchases for state-owned buildings by at least 20 percent by 2018; requiring all new state buildings and major renovations designed after 2025 to be constructed as ZNE; and achieving ZNE for 50 percent of the square footage of existing state-owned buildings by 2025.
- A major effort is underway to improve the measurement and verification (M&V) of the impacts of efficiency initiatives; and application of M&V to design more effective efficiency programs.

Demand Response

- IOUs are responsible for implementing demand response programs under the oversight and evaluation of the CPUC. The current program cycle (2012-14) has a total budget of approximately $1 billion per year for a variety of energy efficiency programs. It is anticipated that some of these programs will provide over 2,000 MWs of demand response capacity during the peak hours. Demand response receives Resource Adequacy credits, thereby displacing supply-side generation capacity that the utilities would otherwise procure.
- In 2012, the CPUC adopted a decision[15] that sets policies for the participation of demand response in California ISO wholesale energy markets. These policies

[14] Executive Order B-18-12, April 25, 2012, http://gov.ca.gov/news.php?id=17508

[15] D.12-11-025 http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M037/K494/37494080.PDF

are expected to be embodied in a set of utility tariff rules, known as "Rule 24". The purpose of Rule 24 is to provide the administrative, technical, and financial mechanisms to allow demand response providers to bid resources directly into the California ISO market while protecting customers and ratepayers. Finalization of Rule 24 is anticipated in 2014.

- Starting in 2006, the CPUC began authorizing the deployment of smart meters by IOUs across their respective territories. Smart meters can measure customer energy usage in hourly increments or less, and are necessary for customer participation in demand response programs or time-varying rates. Smart meter deployment has now been completed by Pacific Gas and Electric (PG&E), San Diego Gas and Electric (SDG&E), and SCE, although PG&E will still be working on a few remote locations until the end of 2013. This does not, of course, include those households that have opted out of receiving a smart meter.

Renewables

- In 2011, California codified and implemented an RPS program requiring 33 percent of retail sales to be served by renewable energy by 2020. The RPS requires retail sellers of electricity and publicly-owned utilities to procure: an average of 20 percent of retail sales from eligible renewable resources between January 1, 2011 and December 2013, quantities that reflect reasonable progress sufficient to achieve 25 percent by December 31, 2016, quantities that reflect reasonable progress sufficient to achieve 33 percent by December 31, 2020, and no less than 33 percent in all subsequent years.[16] In 2012, California served about 22 percent[17] of retail sales with renewable energy.
- During 2012, nearly 2,000 MW of new large-scale renewable generation came on line[18] and more than 3,000 MW is scheduled to come online before the end of 2013. In addition, in 2012, the IOUs filed 63 new contracts for 1,311 MW of renewable capacity and the CPUC approved 64 contracts representing 3,725 MW of renewable capacity.[19] In the last few months, the California ISO has witnessed a number of record breaking events for renewable generation of wind and solar. Wind broke the 4,000 MW instantaneous capacity mark in April 2013 and solar broke the 2,000 MW instantaneous capacity mark in early June 2013, which do not include the nearly 1,500 MW of solar photovoltaic behind the meter. The California ISO will likely continue to shatter the solar record as more capacity is installed.

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[16] Senate Bill X1-2 Simitian, Chapter 1, Statutes of 2011.

[17] Energy Commission staff estimate, based on data from the Renewable Net Short data, http://www.energy.ca.gov/2013publications/CEC-200-2013-001/CEC-200-2013-001.pdf for 2012 and the Preliminary California Energy Demand Forecast , June 2013 http://www.energy.ca.gov/2013_energypolicy/documents/2013-05-30_workshop/spreadsheets/

[18] California Public Utilities Commission, *Renewables Portfolio Standard Quarterly Report*, 3rd and 4th Quarter 2012, http://www.cpuc.ca.gov.

[19] California Public Utilities Commission, Renewables Portfolio Standard Quarterly Report, 3rd and 4th Quarter 2012, http://www.cpuc.ca.gov/NR/rdonlyres/4F902F57-78BA-4A5F-BDFA-C9CAF48A2500/0/2012_Q3_Q4RPSReportFINAL.pdf.

- Progress was made toward the SB 1 program goal of 3,000 MW of self-generation solar by the end of 2016, and towards the Governor's goal of 12,000 MW of renewable DG (20 MW or less) by 2020. As of January 2013, renewable DG facilities (20 MW or smaller) operating in California totaled more than 3,800 MW, with over 1,700 MW pending as of January 2013.[20] About half of these installations are behind the meter and in addition to the renewable capacity noted above.

Fossil-fuels

- Natural gas: In the end-use sector, several decades of building and appliance standards and utility efficiency programs have decreased per capita natural gas use, causing total natural gas consumption to remain flat in spite of California's increasing population. In total, an incremental 322 MM therms[21] were avoided by the incorporation of state and federal standards into building design and appliance operation from 2008 to 2013.[22]

  Because residential natural gas use is primarily addressed through standards, utilities have focused more of their energy efficiency assistance on the industrial and commercial sectors.[23] The California Solar Initiative established incentives for replacing residential gas or electric water heating with solar water heating. Because natural gas accounts for 90 percent of domestic water heating, this is primarily a natural gas measure.

  For industrial natural gas use, ARB has conducted audits to help facilities identify energy saving opportunities. Natural gas that fuels large industry and refineries that emit more than 25,000 metric tons of CO_2E per year was included in the first phase of cap-and-trade covering emissions from 2013 through 2014. Fuel distributors, such as natural gas utilities, that emit more than 25,000 tons of CO_2E per year will be added in the second phase from 2015 to 2020.

- Coal: Termination of out-of-state coal contracts and the conversion or closure of in-state coal burning facilities will largely be accomplished by 2020. Due to utilities' change-over investment, generation from coal and the associated GHG emissions will drop by three-fifths between 2010 and 2020. California's Emission Performance Standard (SB 1368, Perata, Chapter 598, Statutes of 2006) prohibits California utilities from renegotiating or signing new contracts for baseload generation that exceeds 1,100 lbs of CO_2E emission per MWh, absent a coal-fired plant's ability to sequester roughly half or more of its GHG emissions.

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[20] California Energy Commission, http://www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf

[21] Computed from *California Energy Demand, 2012 Final Forecast*, June 2012, Form 2.X, Natural Gas Efficiency Impacts.

[22] California Energy Commission, *California Energy Demand, 2012-2022 Final Forecast, Volume 1: Statewide Electricity Demand and Methods, End-User Natural Gas Demand, and Energy Efficiency,* June 2012, http://www.energy.ca.gov/2012publications/CEC-200-2012-001/CEC-200-2012-001-CMF-V1.pdf.

[23] See CPUC data website for IOU details at: http://eega.cpuc.ca.gov/.

California utilities retain ownership shares in two out-of-state coal plants whose contracts expire after 2020. Several California utilities co-own San Juan Units 3 and 4 in Farmington, New Mexico with purchase obligations that expire in the 2020's, but are pursuing early divestiture of these facilities. Early divestiture makes sense for these utilities in light of significant investments that will be necessary to comply with federal pollution standards and the relative cost advantage of natural gas generation over coal. The Los Angeles Department of Water and Power recently stated its intent to convert the Intermountain Power Plant in Delta, Utah to natural gas by 2025, and is working with the other plant owners to accomplish this conversion. Los Angeles Department of Water and Power also announced in 2013 that it is divesting its interest in the coal-burning Navajo Generating Station by 2015, which it plans to replace with solar power from Copper Mountain 3 and K Road Moapa Solar projects as well as gas-fired generation from Apex Power Project. Divestitures of coal from California have resulted in utilities from other states following suit. For example, NV Energy from Nevada supported legislation requiring exit from Navajo and Reid Gardner and PNM of New Mexico supported a partial retirement of San Juan Generating Station.

Also, cap-and-trade has resulted in several coal or petroleum-coke plants closing or converting to biomass in California. For example, in 2012 Rio Bravo-Jasmin (38 MW), Rio Bravo-Poso (38 MW) and Hanford LP (24 MW) closed. Mount Poso Cogeneration (64 MW) in Kern County and DTE Stockton (50 MW) converted to biomass.

- Combined Heat and Power: CHP, both heat and electricity, emissions dropped from 11.86 MMT CO2E in 2008 and 9.62 MMT CO2E in 2011 as reported to the ARB.[24] The reduction was largely because some older, less efficient facilities shut down. However, CHP continues to be the most efficient technological approach to meet large on-site thermal and electrical loads, especially with today's advancements in combustion technology, stationary fuel cells, and waste-heat recovery devices.

Electricity Planning, Permitting, Siting, and Grid Management

- Reducing the GHG impacts of electricity cannot occur without a wide array of supporting infrastructure activities. Over the past several years, state and local governments have prepared planning guidelines for where and how new renewable energy projects may be sited.
- Between 2008 and 2011, the Energy Commission provided permits for nine large solar thermal power plants and two natural gas/solar thermal hybrid projects. The Bureau of Land Management and local governments also permitted many renewable energy projects. In all, over 170 renewable energy power plants have been permitted since 2010 that will have a maximum capacity of over 19,000 MW.

[24] ARB, http://www.arb.ca.gov/cc/reporting/ghg-rep/reported_data/ghg-reports.htm#registering_specified.

- The Desert Renewable Energy Conservation Plan (DRECP) is a collaborative, comprehensive effort to plan for the development of renewable energy and environmental conservation in the Mojave and Colorado deserts.
- Utilities and the California ISO have worked diligently to analyze and start funding the transmission and distribution infrastructure necessary to incorporate new renewable projects into the electricity grid. The California ISO and utilities are developing new software and tariffs to provide economic signals for desirable generation attributes and effective monitoring of the system so that reliability and safety are maintained. In addition, the CPUC has been working with the California ISO to define the types and quantities of flexible generation that will be needed to support large quantities of variable wind and solar generation.
- In February 2013, the California ISO and PacifiCorp entered into a memorandum of understanding to create a regional real-time energy imbalance market by October 2014. This regional market will provide ease of entry for balancing authorities and optimize supply and demand with more precision through 5-minute energy dispatch which will help grid operators better integrate renewable resources into the electricity system. The California ISO board approved the design framework for the energy imbalance in November 2013.[25] Nevada's leading utility company (NV Energy) announced its plan to seek permission from Nevada regulators to allow it to participate in the energy imbalance market. The Nevada utility company, in cooperation with the California ISO, recently completed a regional imbalance market analysis. The results of the analysis demonstrate that participation in a regional imbalance market would benefit consumers in Nevada and California.

Research and Development

Research and development efforts have laid the groundwork for achieving many of the activities noted above. In the last decade, the Energy Commission's PIER and Natural Gas Research Programs have been the state's premier energy RD&D programs, advancing science and technology in the fields of energy efficiency, renewable resources, DG, smart grid[26], energy storage, pipeline safety, transportation, and climate vulnerability and readiness for the energy sector. Between 2008 and 2012, PIER provided $233 million in funding for RD&D in the electricity sector and $87 million for the natural gas sector as discussed below.

- Energy efficiency and demand response RD&D includes: advanced HVAC, lighting, consumer and office electronics (plug loads), building envelopes, hot water heating and distribution, food service operations, ZNE buildings, indoor

[25] California ISO, *Decision on Energy Imbalance Market Design*, http://www.caiso.com/Documents/Board%204)%20Decision%20on%20energy%20imbalance%20market%20design

[26] As defined in the 2012 Integrated Energy Policy Report Update, an electric grid that uses computer intelligence and networking to allow all components of the grid to both "talk" and "listen," thereby improving operations, maintenance, and planning.

environmental quality, development of OpenADR (automated demand response),[27] and improvements to industrial, water/wastewater and data center processes. Energy Commission-funded innovations in these areas resulted in new industry standards and significant energy savings: demonstrations of smart data center cooling technologies already save 17.7 GWh, or $1.7 million, in California and the technologies are expected to be saving up to $45 million by 2020, avoiding up to 111,000 metric tons of CO_2 emissions by that year.[28] OpenADR is another product of research that continues to spread and provide energy and cost savings. It currently reduces peak load in the state by 260 MW annually and has projected savings in California of up to $118 million by 2020.[29] RD&D also contributed to 14 enhancements to the Building and Appliance Energy Efficiency Standards, which will save ratepayers an estimated $10.1 billion between 2005 and 2025.[30]

- Renewable energy and CHP RD&D includes: cost reductions, improved generation efficiency, improved durability and maintainability, renewable resource characterization and management, hybrid generation and fuel flexibility, energy storage, integration of intermittent resources, DG, CHP, clean fossil fuel (primarily natural gas), and microgrids coupled with clean technologies like renewable energy, energy efficiency, demand response, and electric vehicles while maintaining reliability for vital loads.
- CCUS reduces GHG emissions in two ways: (1) through gas separation processes at large point sources such as power plants and refineries to create CO2 streams for productive economic use with integral storage and/or long-term deep geologic storage, and (2) carbon storage through terrestrial projects such as tree planting and wetlands. Research efforts have included forest management pilots and associated carbon stock measurements, drilling a well to characterize the geologic storage potential of the Central Valley, bench-scale research and a roadmap to identify carbon utilization options to meet the state's 2020 and 2050 goals, and analyses of the technical, economic, political, and social aspects of commercial application of CCUS.

The CPUC has established funding and is considering investment plans for a new program to support pre-commercial clean energy technologies and strategies. This program, known as the Electric Program Investment Charge (EPIC), is designed to provide funding for research and development, technology demonstration and deployment, and market facilitation. The CPUC has identified the Energy Commission and the state's three largest IOUs to administer EPIC. The Energy Commission's

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[27] OpenADR is a communication standard protocol to increase demand response availability in California. ADR substantially increases participation compared to manual systems.

[28] *Public Interest Energy Research 2012 Annual Report*, Publication # CEC-500-2013-013-CMF, March 2013, pages 37-38.

[29] *Public Interest Energy Research 2012 Annual Report*, Publication # CEC-500-2013-013-CMF, March 2013, page 44.

[30] *Public Interest Energy Research 2012 Annual Report*, Publication # CEC-500-2013-013-CMF, March 2013, page 22.

portion of the EPIC program proposes to invest over three years: $158.7 million in applied research and development, $129.8 million for technology demonstration and deployment, and $43.3 million for market facilitation of pre-commercial clean energy technologies, plus $50 million for the New Solar Homes Partnership.[31] PG&E, SCE, and SDG&E will administer $86.6 million for technology demonstration and deployment projects. The benefits to electricity ratepayers include greater reliability, lower costs, and increased safety, and reduced GHG emissions.

In November 2012, the administrators filed investment plans addressing the first three years of the program with the CPUC. In June 2013, Governor Brown signed the state's 2013-14 fiscal year budget act, authorizing the Energy Commission to expend EPIC funds. In September 2013, Governor Brown signed SB 96 which provides additional program guidance for EPIC. The CPUC issued a proposed decision on the first investment plans submitted by the four program administrators in October 2013. The proposed decision, in accordance with SB 96, denies the Energy Commission's request for an additional $25 million in 2013 and 2014 for purposes of funding the New Solar Homes Partnership. On November 14, 2013, the CPUC adopted Decision 13-11-025, approving the first investment plans for EPIC.

Climate Change Impacts on the Electricity and Natural Gas Sectors

Although California is making advances in reducing GHG emissions, the state is already experiencing climate change and current and expected emissions will result in further climate change that will impact energy demand and supply over the next several decades. Below is a review of potential impacts that draws on various studies as noted and does not use a common set of climate projections.

Energy Demand

Climate change is expected to increase demand for cooling in the increasingly hot and longer summer season and decrease demand for heating in the cooler season. California's residential sector uses relatively little electricity for heating, but the overall demand for electricity will increase as households operate existing air conditioners more frequently and as more air conditioners are installed in regions where there are currently few. Higher temperatures in the next decade could increase demand by up to 1 gigawatt (GW) during hot summer months, although technological advances in energy efficiency could offset some or all of this impact. Further, a 10 percent increase in peak demand is projected by the middle of the century.[32] This peak demand will occur at the hottest time of day when thermal power plants may not be able to deliver at full capacity

[31] California Energy Commission, *Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2012 Through 2014 Triennial Investment Plan*, November 1, 2012. http://www.energy.ca.gov/research/epic/documents/final_documents_submitted_to_CPUC/2012-11-01_EPIC_Application_to_CPUC.pdf

[32] Sathaye, J.A., et al. 2013. Estimating impacts of warming temperatures on California's electricity system. Global Environ. Change, in press, http://dx.doi.org/10.1016/j.gloenvcha.2012.12.005.

(discussed below), requiring a 13 percent nameplate capacity increase for thermal power plants to be able to satisfy increased load. These results are based solely on projected climate change and actual impacts will depend on how the energy system evolves during the 21st century, and superimposing future climate scenarios to the current system may overestimate impacts.

The Energy Commission began factoring climate change into its *2011 Integrated Energy Policy Report (IEPR)* demand forecast to include estimates of the impact on peak demand. Along with an updated peak demand analysis, the *2013 IEPR* preliminary demand forecast incorporates estimates of climate change impacts on electricity and natural gas consumption. Impacts for both peak demand and consumption were developed using temperature scenarios developed by the Scripps Institute of Oceanography based on various climate change models.

Energy Supply

Impacts on energy supply are expected to include reduced efficiency of thermal power plants to generate electricity, reduced capacity of the transmission and distribution infrastructure, increased damage from extreme weather events, and changes in the availability and timing of renewable resources, particularly hydropower. These impacts were assessed in a comprehensive study conducted by the Lawrence Berkeley National Laboratory (LBNL) for the 2012 California Climate Change Vulnerability and Adaptation Study. The study suggests that the current electricity infrastructure is more vulnerable to climate change than previously believed;[33] although a rapidly evolving electricity system offers the opportunity to reduce that vulnerability.

The LBNL study found that higher temperatures would decrease the capacity of thermal power plants (for example, natural gas, solar thermal, nuclear, and geothermal) to generate electricity during particularly hot periods. The estimated decrease varies by region, emission scenario, and climate model. California's gas-fired generating plants have a nameplate capacity of 44.1 GW, and by the end of the century this could be reduced by 10.3 GW on hot days. Assuming no change in technology advancements or population, the study suggests energy supplies need to increase by about 39 percent by the end of the century simply to meet increased demand resulting from climate change and to offset diminished capacity of thermal generating plants and substations.

The energy system will also become more vulnerable to extreme weather events such as wildfires and flooding.[34] Under some climate scenarios, the likelihood of wildfires occurring near large transmission lines is expected to increase dramatically in parts of California by the end of the century. The LBNL study found a 40 percent increased probability of wildfire exposure for certain transmission lines, including the line that

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[33] Sathaye, J.A., et al. 2013. Estimating impacts of warming temperatures on California's electricity system. Global Environ. Change, in press, http://dx.doi.org/10.1016/j.gloenvcha.2012.12.005.

[34] Sathaye, Jayant, Larry Dale, Peter Larsen, Gary Fitts, Kevin Koy, Sarah Lewis, and Andre Lucena. 2012. Estimating Risk to California Energy Infrastructure From Projected Climate Change. California Energy Commission. Publication Number: CEC-500-2012-057.

brings hydropower generation from the Pacific Northwest to California during peak demand periods. Also, as many as 25 coastal power plants and 86 substations are at risk of flooding or partial flooding due to sea level rise.

The amount and timing of energy generation from renewable resources could change over time due to climate change.[35] Solar photovoltaic and wind energy are likely less vulnerable than conventional power plants to climate change, but the effects of future climatic conditions on wind and solar energy generation in California need to be investigated further.[36]

Hydropower contributes on average about 15 percent of California's in-state generation and provides critical low-cost, low-carbon power in the hot months of the year when electricity demand is at its peak. Higher temperatures will mean that more precipitation falls as rain instead of snow, and the remaining snowpack will melt and run off earlier in the year. The system may not be able to store sufficient water for release in high-demand periods.[37] Many climate projections show a dryer climate by late-century, although some suggest increased precipitation especially in northern California.

Overall, the studies show that the state's efforts to further reduce GHG emissions will be complicated and challenged by the impacts of climate change, even before considering the challenge of fundamentally changing how we use and generate energy to sharply reduce GHG emissions.

Section 3: Vision for Electricity and Natural Gas Sectors: Mid and Long-Term

In 2012, the Energy Commission adopted the following vision as part of an investment plan for clean energy in California:[38]

> "California's future electricity system will consist of near ZNE buildings, highly efficient businesses, low carbon generation, sustainable bioenergy systems, more localized generation, and electrification of transportation, supported by a highly flexible and robust distribution and transmission infrastructure."

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[35] Vine, Edward. 2012. Adaptation of California's electricity sector to climate change. Climatic Change 111:75–99.

[36] Vine, Edward. 2012. Adaptation of California's electricity sector to climate change. Climatic Change 111:75–99.

[37] Guegan M., K. Madani, and C. B. Uvo. 2012. *Climate Change Effects on the High-Elevation Hydropower System with Consideration of Warming Impacts on Electricity Demand and Pricing.* California Energy Commission. Publication number: CEC-500-2012-020.

[38] California Energy Commission, *Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2012 Through 2014 Triennial Investment Plan*, November 1, 2012. http://www.energy.ca.gov/research/epic/documents/final_documents_submitted_to_CPUC/2012-11-01_EPIC_Application_to_CPUC.pdf.

This vision could be expanded to allow for a future that includes more significant use of hydrogen or possibly biofuels in addition to electrification of the transportation sector. Also, further emphasis is needed on increasing efficiency in existing buildings as ZNE for new construction will be a small fraction of total housing in the mid-term and even 2050.

In the electricity sector, energy efficiency gains are needed and energy production must be highly decarbonized by 2050. Some natural gas will likely be needed to meet reliability requirements and should be coupled with CCUS technologies. Electricity generation will likely rely heavily on renewable resources, but other low-GHG solutions could also be considered for the 2050 timeframe, including nuclear and even fusion. The state also encourages local governments to find creative ways to lower GHG emissions from the electricity sector by providing local communities with the choice to purchase electricity with a higher renewable content. In addition, the Energy Commission encourages local governments to adopt residential building efficiency "Reach Standards" which are more stringent than state minimum energy efficiency standards.

What breakthroughs will happen by 2050 is unknown, but 40 years ago no one imagined the monumental changes that have occurred in personal computers and software and in the energy sector, including the introduction of competition in generation and retail sales, the emergence of natural gas as the primary fossil fuel, improvements of 30 percent in the thermal efficiency of gas-fired generation, stunning increases in the cost competitiveness of solar generation, advancements in smart grid, and revolutionary advances in load management technologies. Further innovation and breakthroughs are critical for the state to make the deep cuts in GHG emissions needed by 2050.

Overview of State and National Studies, 2050 Vision

Studies at the national and international levels (ECF, 2010;[39] CCSP, 2007[40]) suggest that the best option for deep GHG emission reductions involves substantial improvements in energy efficiency, followed by deep decarbonization of electricity generation, and the electrification of most energy services (e.g. heating homes and buildings using electricity). As discussed below in the section on Solar Space and Water Heating, solar thermal applications can provide a better option, both environmentally and economically, for natural gas displacement in the residential and industrial sectors than electrification.

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[39] ECF. European Climate Foundation, "Roadmap 2050: A practical guide to a prosperous, low-carbon Europe, technical analysis" (Brussels, 2010; www.europeanclimate.org).

[40] CCSP, 2007: Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations (Part A) and Review of Integrated Scenario Development and Application (Part B). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Clarke, L., J. Edmonds, J. Jacoby, H. Pitcher, J. Reilly, R. Richels, E. Parson, V. Burkett, K. Fisher-Vanden, D. Keith, L. Mearns, C. Rosenzweig, M. Webster (Authors)]. Department of Energy, Office of Biological & Environmental Research, Washington, DC., USA, 260 pp.

In 2004, Pacala and Socolow[41] analyzed how to globally reduce GHG emissions using existing technologies, which provides a useful framework for California. The Pacala and Socolow study represented the necessary emission reductions as a triangle, where stabilization of fossil fuel use is a "flat" trajectory, business as usual is an upward "ramp," and the difference between the two trajectories forms the "stabilization triangle." To bring global emissions down, the triangle is divided into equal "wedges" that include 15 measures such as reducing vehicle miles traveled, increasing building and appliance efficiency, increasing the use of renewable fuels, replacing coal with natural gas, introducing CCUS at baseload gas or coal facilities, and decreased deforestation.[42] Recent research suggests that additional wedges are necessary to meet GHG emissions reduction goals, including 10 new wedges to phase-out all CO2 emitting land-use practices.[43]

Looking at how California can reach its 2050 GHG reduction goal, three recent studies (Williams et al., 2011; Greenblatt et al., 2012; Wei et al., 2013) used different methodologies and assumptions about the availability of resources and technologies, but reached the same general conclusion: reducing GHG emissions by 80 percent by 2050 is *technically* feasible. However, these deep reductions would require similar efforts outside California in large areas such as the Western Electricity Coordinating Council (WECC)[44] region. Some of the overall findings from the California studies are discussed below, and the appendix summarizes the assumptions and findings of the three studies.

One step needed to achieve the 2050 GHG emission reduction goal is to enhance energy efficiency programs to dampen growth of electricity demand by about 1.3 percent per year relative to forecasted demand.[45] This rate is similar to the observed rate of efficiency and conservation[46] gains during the 2000-2001 electricity crisis but "is historically unprecedented over a sustained period."[47] If there are no improvements in energy efficiency (frozen efficiency case), a study by Wei et al (2013) suggests that the 2050 GHG emission reduction goal will not be achieved. However,

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[41] Pacala, Stephen W., and Robert H. Socolow, 2004: Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. Science, 305, doi:10.1126/science.1100103 968-972. http://www.princeton.edu/mae/people/faculty/socolow/Science-2004-SW-1100103-PAPER-AND-SOM.pdf.

[42] Pacala, Stephen W., and Robert H. Socolow, 2004: Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. Science, 305, doi:10.1126/science.1100103 968-972. http://www.princeton.edu/mae/people/faculty/socolow/Science-2004-SW-1100103-PAPER-AND-SOM.pdf.

[43] Davis, Steven; Cao, Long; Caldeira, Ken; Hoffert, Martin. *Rethinking Wedges*. Environmental Research Letters. 2013 IOP Publishing LTD. http://iopscience.iop.org/1748-9326/8/1/011001.

[44] WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or portions of the 14 Western states.

[45] Williams et al., 2011.

[46] Efficiency refers here to the provision of similar levels of energy services but using less energy. Conservation reduces energy services (e.g., curtailed electricity demand during peak demand periods).

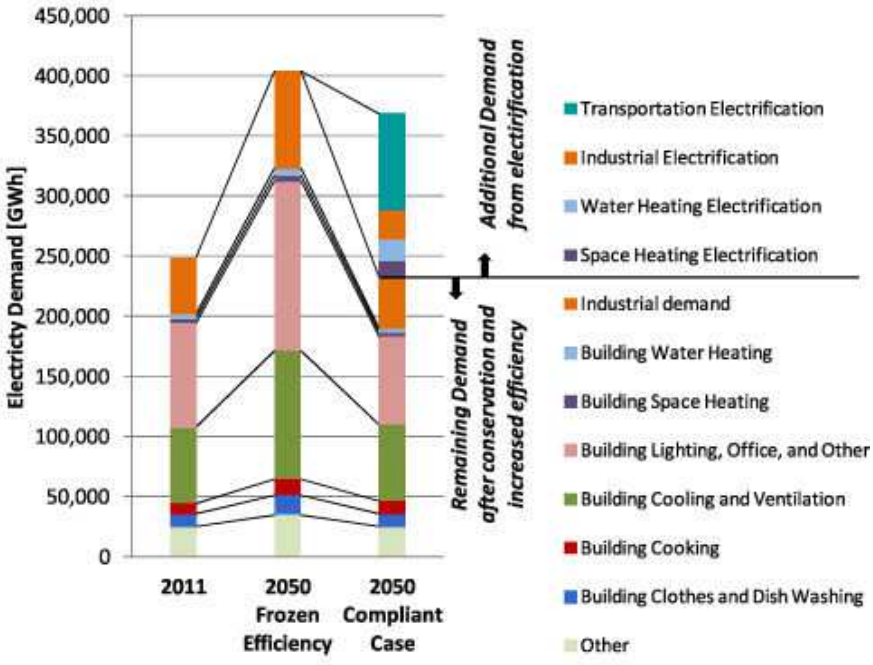
[47] Williams et al., 2011.

that study also finds that the 2050 GHG emission reduction goal *can* be achieved through a scenario with high energy efficiency and heating electrification, industrial electrification, and electrification of most of the transportation sector.[48]

Wei et al. (2013) find that total natural gas demand in 2050 would be greatly reduced if energy services that currently depend on natural gas were electrified (e.g. water and space heating). All three California studies (Williams et al., 2011; Greenblatt et al., 2012; Wei et al., 2013) suggest that while most of the transportation sector would also be electrified, biofuels would serve transportation services that cannot be electrified such as air and marine transport.

The Wei et al. (2013) 2050 compliance scenario shown in **Figure 1** assumes that the electrification of transportation becomes a major source of electricity demand with most electric vehicle charging occurring at night.[49] This, together with electrification of space heating, would change the electricity demand load profiles for California, with peak demand showing up at night and during the winter season. The traditional summer electricity peak driven by demand for air conditioning would continue. Nightly winter peaks would tend to make wind power more attractive because wind energy is usually produced at night.

Figure 1. Electricity Demand Scenarios to reduce California Greenhouse Gas Emissions to 80 percent below 1990 levels by 2050



Source: Wei et al, 2013

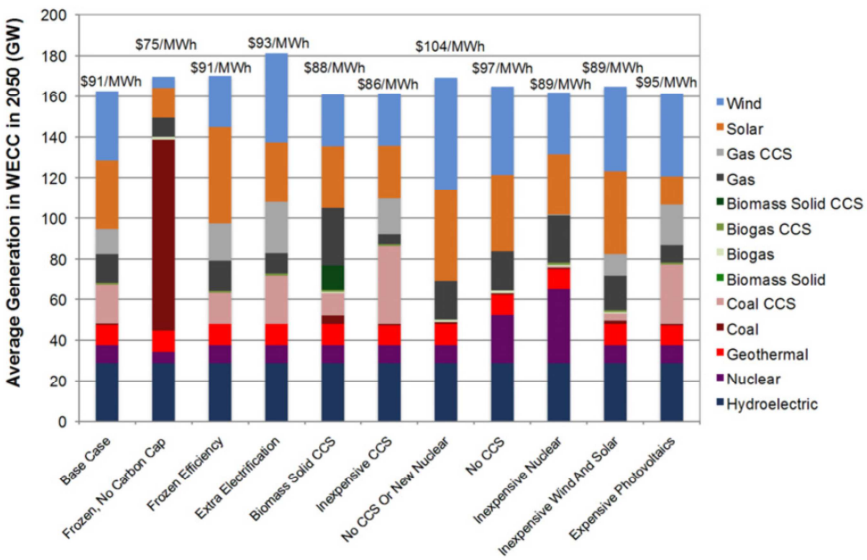
[48] Wei et al., 2013.

[49] Wei et al, 2013.

2050: Studies indicate need for Heavily Decarbonized Electricity Generation

The three studies find that there are multiple decarbonization options for the electricity system. Wei et al. (2013) used a relatively sophisticated model of the electricity network for the WECC with hourly simulation of electricity demand and resource availability. As shown in **Figure 2**, the contribution of natural gas-fired power plants to average generation in the WECC would be relatively minor by 2050. To put things in perspective, in recent year's power plants burning natural gas provided about half of the electricity generated for California. The study by Wei et al (2013) suggests that natural gas-fired power plants will provide some limited amount of energy because they will still be needed to address the intermittent nature of wind and solar.

Figure 2. Comparison of 2050 Low Greenhouse Gas Scenarios by Fuel Type in WECC



Source: Wei et al, 2013

The study by Williams et al. (2012) sets an upper limit of 74 percent on the amount of renewable electricity generation resources serving California by 2050; others have estimated an 80 percent upper limit for renewables at the national level by 2050[50] including large hydropower. In California, large hydropower does not count towards the 33 percent RPS by 2020 target, but provides about 10 to 20 percent of electricity for California (in-state and out-of-state generation).[51] Also, the studies did not attempt to capture operational constraints of such high amounts of intermittent renewable penetration and further analysis by the California ISO is needed.

[50] NREL, 2012.

[51] For example, 2011 Total System Power data show large hydropower provided 13 percent of generation for California. http://energyalmanac.ca.gov/electricity/total_system_power.html.

To build on synergies and avoid working at cross purposes across sectors, the Governor has set an economy-wide goal of 80 percent reduction in GHGs by 2050.[52] For planning purposes within the electricity sector, one pathway toward achieving the economy-wide goal is to aim for 80 percent reduction in GHGs within the electricity sector. However, achieving this vision poses a tremendous challenge for California and the Western United States. Williams et al. (2012) demonstrate that without an economy-wide 80 percent reduction goal, GHG emissions outside of the energy sector could grow substantially. Other studies (Hyman et al., 2002[53], Fujino et al. 2012[54]) suggest that reductions outside the energy sector (including electricity, natural gas, and transportation) could be accomplished at lower costs, potentially decreasing the need for deeper cuts in the energy sector.

Additional Considerations

The studies discussed above provide a good framework for considering how to achieve the 2050 GHG reduction goal, but additional considerations need to be addressed. For example, recent measurements of ambient methane in California[55] suggest that the ARB's GHG inventory may be underestimating total methane emissions. In addition, measurements of carbon 14 in methane[56] in ambient air strongly suggest, at least in the Los Angeles region, that most of the observed "excess" or "fugitive" methane comes from fossil fuels.[57] Other analyses point to the natural gas system as the main source of methane, caused by leakages somewhere in the extraction, transmission, distribution, or end use of natural gas in California.[58,59] The emissions are potentially high enough to substantially diminish the comparative advantage of natural gas in relation to other fossil fuels from a climate perspective. However, the U.S. Environmental Protection Agency recently released its new Inventory of U.S. Greenhouse Gas Emissions and Sinks[60] which includes an overall 20 percent reduction of annual emissions from the U.S.

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[52] http://www.gov.ca.gov/news.php?id=17472 .

[53] Hyman, R. C., J. M. Reilly, M.H. Babiker, A. De Masin, H. D. Jacoby. (2002). Modeling non-CO2 greenhouse gas abatement. Environmental Modeling and Assessment. 8: 175-186.

[54] Fujino, J., Nair, R., Kainuma, M., Masui, T., & Matsuoka, Y. (2012). Multi-gas mitigation analysis on stabilization scenarios using AIM global model. The Energy Journal, (Special Issue# 3), 343-354.

[55] Methane, a potent greenhouse gas, was measured in ambient air in a tall tower in California (Zhao et al., 2009; Seongeun et al., 2011), using research aircrafts (Wennberg et al. 2012), and ground level monitoring stations (Hsu et al., 2010).

[56] Carbon 14 is an isotopic form of carbon that slowly decays with time. Carbon in methane (CH_4) associated with fossil fuels does not include this form of carbon.

[57] Townsend-Small A, Tyler SC, Pataki DE, Xu X, and Christensen LE (2012). Isotopic measurements of atmospheric methane in Los Angeles, California, USA reveal the influence of "fugitive" fossil fuel emissions. Journal of Geophysical Research. 117, D07308, doi: 10.1029/2011JD016826.

[58] Wennberg, P. O., W. Mui, D. Wunch, E. A. Kort, D. R. Blake, E. L. Atlas, G. W. Santoni, S. C. Wofsy, G. S. Diskin, S. Jeong and M. L. Fischer. 2012. On the Sources of Methane to the Los Angeles Atmosphere. Environmental Science & Technology. 46: 9282–9289.

[59] Peischl, J et. al. 2013. Quantifying sources of methane using light alkanes in the Los Angeles basin, California. Journal of Geophysical Research: Atmospheres. DOI: 10.1002/jgrd.50413.

[60] U.S. EPA. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2001 (April 2013). http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

natural gas system as a result of reduced estimates of methane emissions associated with hydraulic fracturing. Cost effective emission reduction options seem to be available for the natural gas sector[61]as well as mechanisms to recover and use methane to produce electricity and heat.[62] Ongoing and forthcoming studies will provide more information about fugitive methane emissions and explore ways to cost effectively reduce them from California's natural gas system.

Another consideration is how California's portfolio of renewable technologies can increase or minimize needs for flexible capacity. This is discussed in the section on integration issues.

Electrification of the transportation sector will likely have profound impacts on the electricity sector. While Wei et al. (2013) assume electric vehicles will be charged over night, there is considerable uncertainty about charging behavior. Charging behavior uncertainties include: when vehicles will be charged, the prevalence of fast charging technologies, and the geographic dispersion of electric vehicle charging. The Energy Commission is engaged in RD&D to address some of the volatility and stresses electric vehicles may have on the grid.

In addition, while the studies discussed above emphasize electrification of the transportation and industrial sectors, other pathways should also be explored. For example, rather than electrifying the heating sector, it may be possible to expand the use of solar technologies to meet heating and cooling demand in the residential and industrial sectors. In the transportation sector, hydrogen or biogas – rather than just electrification – could reduce GHG emissions.

Consideration should also be given to disadvantaged and low income communities in urban and rural areas that bear a disproportionate burden from air pollution, disease, or other effects from burning fossil fuels. Although criteria pollutants from in-state electricity generation are relatively small, the pollution is concentrated in disadvantaged communities and those communities are disproportionately exposed to emissions from goods transport.[63] Deploying renewables in disadvantaged communities can provide local benefits by helping to increase employment opportunities as discussed further in the Renewable Energy Generation section. Also, the state must explore how to ensure that disadvantaged and low-income communities most impacted by the effects of air pollution can participate in the electrification of the transportation system and realize its benefits.[64]

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[61] Natural Gas STAR Program. http://www.epa.gov/gasstar/methaneemissions/index.html

[62] International Energy Agency, Energy Sector Methane Recovery and Use: the Importance of Policy, 2009.

[63] Transcript of Energy Commission Lead Commissioner Workshop on Evaluating and Capturing Benefits of Renewable Energy for California, April 12, 2012, comments by Laura Wisland, Union of Concerned Scientists, p246.

[64] California Energy Commission, 2012. *2012 Integrated Energy Policy Report Update*. Publication Number: CEC-100-2012-001-CMF. http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf

Climate change considerations coupled with market forces and existing regulatory requirements will be a major driver of how the energy system will evolve during the 37 years between now and 2050. As in the past, air quality requirements may also exert considerable influence. For example, to attain federal air quality standards, the South Coast Air Quality Management District will need to cut emissions of oxides of nitrogen (NO_x) by about 80 percent from 2010 levels by 2023, and almost 90 percent by 2032. Similar levels of emissions reductions are likely needed in the San Joaquin Valley (CARB, 2012).

Setting an Interim Target to 2050

Recognizing the uncertainty surrounding technological, economic and socioeconomic changes over the next several decades, state agencies should pursue a set of GHG emission reduction strategies to achieve the 2050 goal rather than relying on a single strategy. There are multiple ways to transform the electricity and natural gas sectors to meet the 2050 goal. Although all pathways pose significant challenges and it is unknown which pathway will be successful, reaching the goal will be easier if the state has more options. The loading order provides a guiding principle for energy policy in California to help guide investments.

Setting interim goals can help ensure progress. For example, if by 2030-2035 the state hasn't made breakthroughs in energy storage, advancing efficiency in existing buildings, and electrifying the transportation sector, then the state will need to re-evaluate its efforts to reduce GHGs.

The Pacala and Socolow framework provides a way to break down the daunting task of reducing GHG emissions by 80 percent into manageable pieces.[65] By dividing expected emission reductions into "wedges" – various actions that collectively meet the overall goal – they establish a diversified portfolio to help manage uncertainty and reduce risk. A downside of this framework is that it can provide the false impression that the solution is easy.[66] Also this framework does not account for interactions between emission reduction efforts or the need for sequencing such as pursuing energy efficiency first, followed by electrifying the transportation sector, and then decarbonizing electricity generation. Recognizing these limitations, the wedge concept provides a useful framework for discussing pathways to reduce GHG emissions.

For California, wedges of GHG emissions reductions in the electricity sector address both energy demand and supply. Below is an overview of the vision, challenges, and

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[65] Pacala, Stephen W., and Robert H. Socolow, 2004: Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. Science, 305, doi:10.1126/science.1100103 968-972. http://www.princeton.edu/mae/people/faculty/socolow/Science-2004-SW-1100103-PAPER-AND-SOM.pdf.

[66] Davis, Steven; Cao, Long; Caldeira, Ken; Hoffert, Martin. *Rethinking Wedges*. Environmental Research Letters. 2013 IOP Publishing LTD. http://iopscience.iop.org/1748-9326/8/1/011001.

recommendations for each wedge. For each wedge, innovation is needed to achieve deep GHG emission reductions, suggesting that RD&D will be critical.

Demand-Side

Demand-side wedges as proposed in this working paper are efforts to increase energy efficiency, demand response, and CHP. In addition to benefits such as reducing costs and criteria pollutants, lowering energy demand reduces the state's burden to develop non-GHG emitting energy sources to meet its energy needs.

Energy Efficiency

California's energy policies have long emphasized energy efficiency, and much of the legislation enacted over the past two decades requires the state to meet its energy needs first with energy efficiency and demand-side resources. Similarly, the first priority in any plan to dramatically cut GHG emissions should be to increase energy efficiency, consistent with the loading order.

California's Building Energy Efficiency Standards are one of the primary strategies to increase energy efficiency and set a path toward the goal for ZNE new residential buildings by 2020 and ZNE new commercial buildings by 2030.[67] Also, there will be ongoing needs and opportunities to optimize building standards beyond these target dates, including: adjusting mix of measures and performance tradeoffs as incremental costs come down and/or shift; incorporating new energy efficiency and DG technologies; adapting the code to more fully reach the more challenging building sectors; minimizing the off-ramps and exceptions to compliance; and simplifying compliance. Further, there may be a need to add water, transportation fueling infrastructure, and/or land use issues to the code. The Energy Commission's *2007 IEPR* emphasized the importance of the building standards to achieve ZNE levels, with a tiered approach being used to achieve ZNE in future standards. The base tier is the traditional mandatory standard that increases in stringency with every code cycle, while additional tiers are voluntary and represent a "reach" standard for advanced levels of energy efficiency. The intent is to give industry and the marketplace a framework to differentiate highly energy-efficient buildings from standard buildings and to pilot these enhanced features to see how well they work before determining which of the measures should be included in future mandatory standards.[68]

The development of appliance efficiency standards is another strategy for reducing energy use in both new construction and existing buildings. Although permanently installed equipment and appliances account for the bulk of building energy use, consumer electronics and other devices that are plugged into outlets ("plug load")

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[67] In 2007, the CPUC adopted four specific programmatic goals known as the "Big Bold Energy Efficiency Strategies" which in addition to the ZNE goals included transformation of heating, ventilation, and air conditioning to ensure that its energy performance is optimal for California's climate and giving all eligible low-income customers the opportunity to participate in the low income energy efficiency program by 2020.

[68] http://www.energy.ca.gov/title24/2013standards/background.html.

represent a growing percentage of building energy consumption and must be addressed to achieve ZNE buildings.

In addition to savings from efficiency standards for new construction, there is significant opportunity for savings in existing buildings. Of California's 13 million existing buildings, more than half of residences and more than 40 percent of commercial buildings were built before 1978, when the state first implemented the Building Energy Efficiency Standards.[69] This leaves open opportunities to significantly decrease energy use in the existing housing market using energy efficiency measures.[70] Even with the continuous improvement of the state's Building Energy Efficiency Standards, there is still significant potential to achieve cost-effective savings within buildings constructed in the 1980s and early 1990s. Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009) requires the Energy Commission to develop and implement a program to achieve cost-effective energy savings in the state's existing residential and nonresidential building stock (AB 758 Program).[71] As identified in the AB 758 action plan development process, energy assessments - particularly when done at the time a building or unit is sold or by a predetermined future certain date - as well as broad public energy use disclosure requirements are effective ways to encourage the reduction of energy use in existing buildings.

Efficiency programs administered by California's utilities are another key element of achieving energy efficiency gains. Additionally, the CPUC approved pilot Regional Energy Networks to give local governments an opportunity to develop a track record as energy efficiency program administrators, a role traditionally held by the IOUs. Regional Energy Networks are aimed at addressing broad geographic areas to achieve deep energy efficiency savings through various tools including financing. The Energy Commission's *2007 IEPR* determined that a statewide efficiency target should be set at 100 percent of economic potential and achieved through a combination of utility and non-utility programs coordinated at the state level by the Energy Commission and the CPUC. The Energy Commission, in consultation with the CPUC and the public utilities, identifies all potentially achievable cost-effective electric and natural gas efficiency potential and establishes 10-year statewide efficiency targets for achieving this potential every four years.

Other opportunities to advance energy efficiency, include a renewed focus on achieving the goals in Executive Order B-18-12 requiring state buildings to become more energy efficient, using Proposition 39 (The California Clean Energy Jobs Act) funds for energy efficiency and clean energy generation projects in schools (K-12) and community

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[69] Brook M., B. Chrisman, P. David, T. Ealey, D. Eden, K. Moore, K. Rider, P. Strait, G. D. Taylor, and J. Wu. July 2011. *Draft Staff Report: Achieving Energy Savings in California Buildings (11-IEP-1F).* California Energy Commission, Efficiency and Renewables Division. Publication number: CEC-400-2011-007-SD.

[70] J. Hodgson, J. Thach, M. Fung, May 2008, *Carbon Footprint of Single-Family Residential New Construction*, California Building Industry Association, http://www.cbia.org/go/cbia/?LinkServID=311F6C70-DB43-4FE7-841A9BAEFCB09228&showMeta=0.

[71] http://www.energy.ca.gov/ab758/.

colleges, and potentially allocating cap-and-trade auction revenues toward existing energy efficiency programs.

Energy Efficiency Challenges

Challenges for increasing efficiency include program participation, cost, and market saturation. Participation in efficiency programs can fluctuate from year to year depending on economics, incentive amounts, and what efficiency measure will "sell" in a given year. Also, even in good economic times many homeowners, landlords, and commercial/industrial property owners are unwilling to spend significant amounts of money on efficiency despite evidence of savings. Making efficiency products attractive enough to entice prospective customers to invest is an ongoing challenge for all of the utilities.

Deploying affordable and effective energy efficiency improvements in all of California's diverse buildings will be a major challenge. Millions of energy upgrades need to be initiated in existing buildings to meet the state's efficiency and GHG reduction goals, which will involve sizeable investments and program coordination for all building types in all regions of the state. California-specific studies of potential GHG emission reductions from energy efficiency assume very deep retrofits of all existing buildings, including all rented space in the residential and commercial sectors. A challenge for rental properties in particular is that building owners have no incentive to pay for efficiency upgrades since it is their tenants who benefit from reduced monthly energy bills (this problem is referred to as a "split incentive"). Because it applies to rented spaces, the AB 758 program has the opportunity to positively impact low-income and disadvantaged communities by increasing employment opportunities and energy savings in those areas. Implementation of the AB 758 Program will need to include close collaboration between partners, stakeholders, and key market actors to transform the market, level the playing field, and convince building owners and decision makers to take action, including resolving critical uptake issues such as the split incentive.

To reach ZNE, a renewable energy source must be integrated into homes and buildings. Cost-effectively integrating renewable energy generation into residential and non-residential buildings will be a challenge and is a concern for adding requirements to Title 24 Building Standards. Steadily increasing plug loads also pose a challenge to meeting the ZNE building goals. If not controlled, the current plug load trajectory could affect meeting the ZNE buildings goals in California by 2020 and is estimated to be about 40 percent of the energy use of a ZNE building.[72] The U.S. Energy Information Administration's 2011 Annual Energy Outlook projects an increase in plug loads of 60 percent from 2010 to 2030, dwarfing traditional categories like lighting and HVAC.[73] As other building loads shrink, plug load will represent a greater portion of overall energy use and make it challenging to achieve significant reductions in building energy

[72] *The Electric Program Investment Charge: Proposed 2012-14 Triennial Investment Plan*, California Energy Commission Report, CEC-500-2012-082-CMF, November 2012, pages 53-54.

[73] http://www.aceee.org/files/proceedings/2012/data/papers/0193-000302.pdf.

consumption. Minimizing plug load, therefore, will be critical to meeting California's ZNE goals.[74]

Challenges for reducing GHG emissions from appliances include the slow turnover rate of products such as refrigerators or HVAC that are not replaced with regular frequency, with resulting market saturation that can affect participation in utility efficiency programs. Also, as electricity-using products become increasingly more efficient, incremental savings diminish and efficiency program costs increase.

One of the biggest challenges to meeting ZNE goals is that California and all other states are preempted from adopting appliance efficiency standards that are more stringent than those covered by federal law. This preemption has been in place since 1987 and prevents California from pursuing energy efficiency standards to aggressively drive down energy consumption for appliances, such as refrigerators, freezers, clothes washers, clothes dryers, dishwashers, air conditioners, heat pumps, furnaces, boilers, water heaters, showerheads, faucets, toilets, light bulbs, lighting fixtures, distribution transformers, pool pumps, motors, consumer audio and video equipment, and battery chargers, that are covered by the preemption. The preemption also affects the building energy efficiency standards because California is prohibited from setting energy budgets for buildings, based on efficiency for air conditioners, furnaces, water heaters and lighting equipment that is any higher than the federal minimum standard. The federal minimum standards are based on a single efficiency level for each type of equipment that is shown to be cost effective for "average" climate conditions in the U.S. and precludes California from setting building standards that are climate-matched, even when higher efficiencies are cost effective by a wide margin. Changing the federal preemption requirements, which have been strongly supported by Congress since their inception, would likely be extremely difficult.

Energy Efficiency Recommendations

Meeting California's efficiency goals will require creative ideas addressing existing building upgrades, new home construction, appliance efficiency, and the perception of efficiency. Building on the recommendations in the 2011 Integrated Energy Policy Report, actions needed are identified below.

Existing Buildings

- There needs to be considerable focus on increasing the efficiency of the existing building stock. The draft action plan for the AB 758 Program proposed three categories of strategies to help California achieve its energy efficiency and GHG emission reduction goals in existing buildings: no regrets strategies, voluntary pathways, and potential mandatory approaches. After considering all information presented at a series of public workshops and in written comments, the Energy

[74] http://www.energydataweb.com/cpucFiles/pdaDocs/904/California_ZNE_Technical_Feasibility_Report_Final.pdf

Commission will finalize the action plan and consider it for adoption in 2014. The CPUC will consider this action plan in the update of their Energy Efficiency Strategic Plan.

New Buildings

- The Energy Commission should adopt triennial updates of mandatory and reach standards to achieve ZNE standards for newly constructed homes by 2020 and newly constructed commercial buildings by 2030.
- The Energy Commission and CPUC should coordinate future IOU "new construction-related" programs with the Energy Commission's efforts to meet the ZNE goals through triennial updates of mandatory and reach standards. By offering incentives for achieving reach standards, providing technology demonstration and development, and conducting pilot programs for demonstrating ZNE solutions, new technologies and building practices will be integrated into upcoming triennial updates of the Title 24 Building Standards and into the market place quicker and with more success.

Appliance Standards

- The Energy Commission, in collaboration with other states, California utilities, and energy efficiency and appliance standards advocacy groups, should intervene in U.S. DOE proceedings to represent the interests of California regarding the upgrade of federal appliance efficiency standards.
- The Energy Commission should continue to engage with the U.S. DOE proceedings to develop common test methods and appliance efficiency databases.
- The Energy Commission should adopt appliance and reach standards that focus on reducing plug loads to enable California's ZNE goals to be achieved.
- The Energy Commission should continue implementation of Public Resources Code section 25402 which requires the Commission to "reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy, including the energy associated with the use of water."

Compliance with Building and Appliance Standards

- The Energy Commission should develop regulations to implement SB 454 (Pavley, Chapter 591, Statutes of 2011), which allows the Energy Commission to adopt an enforcement process for violations of appliance efficiency regulations and impose civil penalties of up to $2,500 for each violation, to increase compliance with the Appliance Standards.
- The Energy Commission and CPUC should jointly pursue improved compliance with the Building Energy Efficiency and Appliance Standards.

Research and Development

- The Energy Commission and the CPUC should collaborate on research to advance technologies and strategies, as well as identify the most cost-effective

opportunities for new appliance standards. The Energy Commission and the CPUC should also reevaluate existing standards and identify the most cost-effective opportunities for updates that will achieve greater energy savings.

- The Energy Commission and the CPUC should collaborate on research to advance technologies needed to achieve ZNE building standards and successfully implement the AB 758 Program; improve efficiency of existing technologies; develop and demonstrate advanced technologies, integrated products, and strategies; encourage adoption through utility incentive programs or building energy efficiency codes; and understand the role of consumer behavior and motivations.

Demand Response

Along with energy efficiency, demand response is the first resource in California's loading order of preferred resources. Demand response is different from energy efficiency in that demand response is a temporary reduction in energy use in response to a signal from the utility or system operator such as a price signal or emergency alert. Current demand response programs are used to reduce peak demand on the electric system, but future demand response programs are anticipated to have more flexibility, such as reducing or *increasing* demand in response to the system needs. Demand response can help integrate intermittent renewables into the electricity system, improve load management to help deal with increasing or shifting load, avoid the need to build additional new fossil generation and transmission, give customers more options to manage their bills, and lower overall electric system costs. However, demand response is not yet a mainstream market resource, particularly in the residential sector, despite extensive groundwork by the Energy Commission, CPUC, and California ISO over the past decade.

California's Energy Action Plan II set a target of meeting 5 percent of peak demand with price responsive demand response in 2007.[75] A 2009 analysis by the Federal Energy Regulatory Commission indicates that by 2019 California could achieve as much as 17 percent of peak demand reduction through demand response if residential customers were defaulted to dynamic rates with the enabling technologies to control dispatch of electricity to the California ISO's wholesale energy markets.[76]

California has come close to achieving the 5 percent demand response goal through traditional reliability programs intended to address system emergencies that can only be triggered under limited circumstances. While reliability demand response is necessary for grid stability, it is not flexible enough to provide integration services for intermittent resources (discussed further in the Renewable Energy Integration section). For example, reliability demand response is generally available 24 hours after customer

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[75] California Energy Commission and California Public Utilities Commission, *Energy Action Plan II*, September 2005, http://www.energy.ca.gov/energy_action_plan/.

[76] FERC, *A National Assessment of Demand Response Potential*, Prepared by the Battle Group, Freeman, Sullivan & Co., and Global Energy Partners, LLC., June 2009. California state profile, pp. 91.

notification, but to help integrate intermittent resources, demand response needs to be reliably available within relatively short timeframes such as 30 minutes of being called upon. The California ISO is developing a roadmap of strategies to more fully realize the benefits of demand response and energy efficiency in contributing to reliable, efficient management of the grid while reducing the need for conventional generating sources.[77] The Energy Commission has considered the findings of the roadmap in developing recommendations to advance DR in the 2013 IEPR.[78]

Demand Response Challenges

Lack of consumer awareness is a major barrier to increased consumer participation in demand response. Outside of the large commercial, industrial, and agricultural pumping sectors, the term "demand response" has little meaning to most residential and small commercial customers. This is largely due to the fact that many of these customers have never been on demand response programs[79] or time-varying rates; therefore, many are not aware of the connection between their use of electricity and system reliability and costs. Customer education about all aspects of demand response programs needs to be improved. In addition, more information is needed regarding what will motivate mass market customers to participate in demand response opportunities. Customers and demand response providers also need transparent and easily accessible information to determine the value of demand response.

Non-residential customers who do participate in demand response are not always able to respond to signals for load reductions, depending on their capabilities and the frequency of the signals. The risk of penalties for non-performance is a major concern of customers who are considering participation, yet the absence of penalties in a program raises concerns that the demand response may not be reliable and therefore cannot be counted on for planning purposes. Participants also need to be convinced that the financial incentives are high enough to offset any potential losses in production or services that could or will occur when they drop load. However, financial incentives for the programs are limited to ensure that the programs are cost-effective for utility ratepayers who fund the programs. Finding the appropriate balance between these perspectives is a continuous challenge.

The disconnect between retail and wholesale rates is also a barrier. Most customers today neither know nor pay the market price of wholesale power. This has led to the creation of demand-side programs in the retail market designed to work around the

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[77] California ISO Demand Response and Energy Efficiency Roadmap: Making the Most of Green Grid Resources, Draft, June 12, 2013, http://www.caiso.com/Documents/Draft-ISODemandResponseandEnergyEfficiencyRoadmap.pdf

[78] http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-LCF.pdf

[79] Residential and small commercial customers have participated in air conditioner cycling programs. In 2012, residential customers in SDG&E and SCE territories participated in Peak Time Rebate programs for the first time.

absence of price information. Customers and demand response providers need to accurately calculate the value of their demand response capability.

Demand response remains mostly in the retail market as a demand-side resource. From the system operation perspective, lack of demand response participation in the California ISO wholesale energy market is a major challenge. Until demand response is bid and dispatched into California ISO wholesale energy markets, it is not actively competing against energy bids by supply-side resources. The implementation of direct participation rules by the CPUC, as described earlier, will enable demand response to be bid into the California ISO market by utilities, third party demand providers, or customers themselves (if they meet certain eligibility criteria). The Renewable Energy Integration section provides further discussion on demand response.

Demand Response Recommendations

- The Energy Commission has analyzed the technical, economic, market, and policy barriers to the use of demand response to support reliability and help integrate renewable resources as part of the *2013 IEPR*. The Energy Commission worked closely with the CPUC and the California ISO in conducting this analysis. As part of this effort, the Energy Commission has identified five strategies to advance DR: resolve Rule 24 Issues and enable DR participation in the California ISO market, develop pilot test market products, resolve regulatory barriers, continue the collaborative process among the Energy Commission, CPUC, and the California ISO, and gain customer acceptance of DR. To support the expansion of DR in California, state agencies should continue pursuing the strategies set forth in the 2013 IEPR.
- Further RD&D is needed to document and better understand customer response to demand response programs and dynamic prices, develop pilot programs to assess the impact potential of different incentives and customer strategies, and demonstrate and validate the capability of automated demand response to provide ancillary services and support integration of higher levels of renewable generation.

Combined Heat and Power

By 2030, California will also need widespread use of efficient CHP and combined cooling, heating, and power (CCHP) systems, especially systems fueled by biogas and waste heat-to-power systems. Governor Brown has called for 6,500 MW of new CHP capacity by 2030.[80]

CHP and CCHP systems can displace boilers and air conditioners in industrial, residential, commercial, district, public, and university settings. They can also be offered as standard features in new developments. CHP can complement renewable and alternative power systems in helping California meet its ZNE buildings goals by

[80] http://www.jerrybrown.org/sites/default/files/6-15%20Clean_Energy%20Plan.pdf.

providing baseload power for district energy or smart grid systems (smart grid is discussed further in the Integrating Renewable Generation and Distribution sections of this working paper). In addition, CHP systems can be used in emergency situations by operating separately from the electric grid, providing a dependable local energy source for critical services, such as hospitals, universities, grocery stores, hotels, data centers, housing complexes, waste, and water treatment centers.[81]

Recent technological advancements hold promise for CHP to help reduce GHG emissions by 2030 and beyond. Reciprocating engines are expected to continue to play an important role for small-scale systems (5 MW and below) despite current challenges related to complying with strict emissions regulations. Emerging systems that will help CHP meet emission regulations include dual stage catalyst systems where NOx and CO are treated in separate stages, advanced air-fuel control systems for ultra-low NOx emissions, and the integration of a partial oxidation gas turbine with a reciprocating engine.[82]

Advances in other clean energy technologies, such as fuel cells and microturbines, will help commercialize these technologies by the target years. In particular, stationary fuel cell technology is showing significant improvements in lowering overall costs, improving durability, and increasing fuel flexibility, particularly for the 2050 timeframe. Hydrogen production, storage, and fueling are also expected to improve and advance deployment of clean fuel cell technology. Emerging, clean burning, microturbine applications increase their flexibility and versatility, allowing for expanded deployment of the technology.[83]

CHP Challenges

Currently, CHP developers must pay non-bypassable charges to compensate their local utility for their "departing load" from the utility.[84] These charges deter investment in CHP and are expected to increase as utilities seek to recover costs from infrastructure and procurement investments and other costs of business.

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[81] In 2012, during the massive power outage on the East Coast after Hurricane Sandy, facilities including hospitals, universities, and some residential buildings were able to keep their power, heat, and critical equipment running because they had CHP systems.

[82] Examples of these technologies are found at the 2012 Public Interest Energy Research Annual Report at http://www.energy.ca.gov/2013publications/CEC-500-2013-013/CEC-500-2013-013-CMF.pdf) and the 2012 Natural Gas Research, Development, and Demonstration Report at http://www.energy.ca.gov/2013publications/CEC-500-2013-008/CEC-500-2013-008.pdf.

[83] Examples of these technologies are found at the 2012 Public Interest Energy Research Annual Report at http://www.energy.ca.gov/2013publications/CEC-500-2013-013/CEC-500-2013-013-CMF.pdf) and the 2012 Natural Gas Research, Development, and Demonstration Report at http://www.energy.ca.gov/2013publications/CEC-500-2013-008/CEC-500-2013-008.pdf.

[84] Note, customer generation departing load that is smaller than 1 MW and is eligible for incentives under the CPUC's Self Generation Incentive Program are exempt from these charges, pursuant to CPUC Decision 03-04-030.

Standby and demand charges can also be costly to projects that have occasional operational issues and go offline for maintenance or other reasons, since going offline for just one fifteen-minute period triggers a demand charge that lasts an entire month. CHP also incurs a demand charge if a fault on the utility system causes the host's CHP system to trip off.

The costs of complying with local NOx emission standards, state GHG standards, and cap-and-trade pose additional challenges to project viability. While advancements in RD&D will help address emission standards, cap-and-trade adds uncertainty about the price of energy from CHP.[85] Under CHP power purchase agreements, the CHP user receives a fixed percentage discount relative to the alternative cost of power from the utility, but that alternative power price is uncertain under cap-and-trade.

Interconnection processes also present both timing and financial challenges. CHP and biomass developers use synchronous generators which often trigger an interconnection requirement to install a mechanical device that shuts the generator down in two seconds if a disturbance is detected. This equipment and the associated communication and control equipment are very expensive and present a significant cost barrier. Finding alternate ways to ensure the safe and reliable operation of these types of generators will be critical for projects using synchronous generators.

Cost issues are further compounded by the likely sunset over the next five years of the financial incentives CHP currently receives. For example, the CPUC's Self Generation Incentive Program ends in 2016, with funding levels declining annually until then.

For fuel cells, further innovation is needed to develop a lower cost fuel cell over the next 15 years. RD&D is needed to find a breakthrough that will reduce fuel cell costs.

Also, some large CHP developers face uncertainty about their ability to secure long-term utility contracts, which provide secure revenue streams for exported electricity. These revenue streams are necessary to attract large upfront capital investments in new facilities. The CHP market is largely shaped by the CPUC's 2010 settlement agreement that created a new Qualifying Facility/CHP Program focused on CHP benefits and GHG emissions reductions with the following goals: (1) IOUs will procure a minimum of 3,000 MW of CHP, and (2) the IOUs will reduce GHG emissions consistent with ARB's 2008 Climate Change Scoping Plan.[86] The 3,000 MW target is expected to be met by 2015 and will likely consist of new contracts for existing CHP (with a contractual exception for San Diego Gas & Electric).[87] Although the GHG reduction goal may require additional CHP solicitations and procurement, there is uncertainty about whether long term contracts will be offered after 2015.

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[85] Hedman, Bruce, Ken Darrow, Eric Wong, Anne Hampson. ICF International, Inc.2012. *Combined Heat and Power: 2011-2030 Market Assessment.* California Energy Commission. CEC-200-2012-002.

[86] http://www.cpuc.ca.gov/PUC/energy/CHP/settlement.htm

[87] CHP Program Settlement Agreement Term Sheet, 5.0 MW Targets, IOUs' MW Targets, 5.1.1. http://www.cpuc.ca.gov/PUC/energy/CHP/settlement.htm.

Finally, CHP is primarily a baseload resource but needs to be dispatchable to help the state address load balancing needs. On December 3, 2012 the California ISO, with assistance from the Energy Commission, implemented its revised tariff definition of regulatory must-take generation related to CHP resources by making it more applicable to facilities capable of producing electricity in conjunction with their industrial processes and thermal energy uses. This new definition allows CHP resources to establish a capacity level eligible for regulatory must-take generation scheduling priority with any remaining capacity eligible for dispatch into the market.[88] Moving forward, the utility system needs a mix of baseload, peaking, and intermediate load following resources to maintain reliable operations.

CHP Recommendations

- Efforts should be made to ensure that new and existing CHP is appropriately valued under future regulatory amendments to California's cap-and-trade program.
- Evaluate potential opportunities to incentivize the development of new bottoming-cycle CHP within existing state programs and the development of new CHP in state and other public facilities. Pursue opportunities on public facilities include development at hospitals and waste water treatment plants throughout California, but particularly in Orange County and San Diego County due to the closure of San Onofre.
- The CPUC, in collaboration with the Energy Commission, should examine and clearly define the interconnection rules for CHP facilities interested in expanding their systems and dispatch capabilities within an existing contract.
- Further RD&D is needed to advance ultraclean emission technologies, reduce costs, integrate emerging, clean CHP technologies in diversified applications, and demonstrate CHP applications using biomass and other feedstocks.

Energy Supply

In addition to significant demand-side measures described above, meeting the 2050 goal requires dramatically cutting GHG emissions from energy generation. Options to decarbonize electricity generation include: renewable energy generation, geothermal energy generation, renewable DG, solar space and water heating, natural gas coupled with CCUS, and nuclear energy.

[88] Regulatory must-take generation, https://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedStakeholderProcesses/Regulatory-Generation.aspx.

Renewable Energy Generation

The RPS is the principal driver of investment in new renewable energy generation capacity for California. Also, as a separate but related policy, Governor Brown set a target of adding 8,000 MW of centralized large-scale renewable facilities by 2020. Distributed renewable generation is discussed separately below. In 2012, California served about 22 percent[89] of retail sales with renewable energy. Unlike many other jurisdictions, California does not include large-scale hydroelectric generation in its renewable energy policies and calculations.

According to Governor Brown, "[w]hile reaching a 33 percent renewables portfolio standard will be an important milestone, it is really just a starting point - a floor, not a ceiling." Williams et al. 2012 puts the maximum penetration of renewable sources[90] of energy serving California by 2050 at 74 percent; at the national level, others have estimated as much as 80 percent.[91] The *2012 IEPR* Update calls for a study to be completed in 2014 of the feasibility of up to 50 percent RPS-eligible energy goal for 2030. Assembly Bill 327 gives the CPUC the authority to require electricity retail sellers to procure eligible renewable energy resources in excess of the 33 percent RPS procurement requirements. In support of discussions relating to the increase of renewable energy generation in California, the California ISO should study the integration requirements needed to support an electricity portfolio that is 50 percent renewable. Studies of a higher renewable energy portfolio should analyze operational issues, costs and GHG savings.

Others are exploring the possibility of meeting all their electricity needs with renewable energy and a growing number of communities in California are setting 100 percent renewable energy targets including Palo Alto, Lancaster, Marin County, San Francisco, San Jose, Santa Barbara, and parts of the city of Los Angeles.[92] These communities are not isolated from the grid and use the grid as storage when they have over or under generation of renewable energy. The California High Speed Rail Authority has committed to using 100 percent renewable energy for powering the rail system which will connect mega regions of the state from Sacramento to San Diego. The ultimate

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[89] Energy Commission staff estimate, based on data from the Renewable Net Short data, http://www.energy.ca.gov/2013publications/CEC-200-2013-001/CEC-200-2013-001.pdf for 2012 and the Preliminary California Energy Demand Forecast , June 2013 http://www.energy.ca.gov/2013_energypolicy/documents/2013-05-30_workshop/spreadsheets/

[90] This includes electricity generation from large hydropower units. Note that the California Renewables Portfolio Standard of 33 percent by 2020 would represent much higher levels of renewables if generation from large hydropower units is considered. Currently generation from large hydro does not count towards the 33 percent target.

[91] NREL (National Renewable Energy Laboratory). (2012). Renewable Electricity Futures Study. Hand, M.M.; Baldwin, S.; DeMeo, E.; Reilly, J.M.; Mai, T.; Arent, D.; Porro, G.; Meshek, M.; Sandor, D. eds. 4 vols. NREL/TP -6A20- 52409. Golden, CO: National Renewable Energy Laboratory. http://www.nrel.gov/analysis/re_futures/

[92] Go 100% Renewable Energy, http://go100percent.org/cms/.

goal is a net-zero system that procures and produces enough renewable energy to offset the energy it uses from the grid.[93]

Renewable generation includes both distributed, small-scale applications (discussed below) and utility-scale facilities. For utility-scale generation, emphasis can be placed on instate development with potential for greater local co-benefits such as local job creation, or a west-wide system striving for a regional, least-cost energy dispatch of an increasingly low- and zero-emission fleet. The current 33 percent RPS emphasizes developing renewable resources within California, but if greater emphasis is placed on regional, west-wide development, California could achieve higher renewable generation targets at lower costs and greater GHG savings.

The grid must be adaptable to handle changes in climate and energy use while maintaining reliability, minimizing land use impacts, and meeting AB 32 and other environmental goals in a cost effective manner. The California ISO conducts an annual transmission planning process covering a 10-year planning horizon, currently through 2022. The transmission plan provides a comprehensive evaluation of the California ISO's transmission grid to identify upgrades needed to successfully meet California's policy mandates, in addition to examining conventional grid reliability requirements and projects that can bring economic benefits to consumers. Approved and pending transmission projects put California in a good position to deliver the renewable generation required to meet the 33 percent RPS, and higher levels by 2030. SCE stated, however, that challenges with building and permitting new transmission lines may hinder the development of these approved projects, potentially causing a delay in reaching their 33 percent RPS requirement.[94] In addition to setting aggressive renewable generation targets, Governor Brown also calls for a dramatic reduction in the permitting time for transmission infrastructure.[95]

An energy imbalance market (EIM) can reduce the need for new transmission with increasing use of intermittent renewables (EIM is further discussed in Renewable Energy Integration section). If renewable levels in 2030 stay closer to 33 percent, or if greater emphasis is placed on developing DG in 2030, then less transmission may be needed, or some may be deferred. The actual transmission needs are highly dependent on the amount, location, and timing of generating resources and load.

Renewable Energy Generation Challenges

The *2011 IEPR* and the *2012 IEPR* Update provide in-depth discussions of the challenges in moving from a century-old system dominated by fossil fuels to one that is "renewable-centric." The challenges include issues relating to planning, permitting and the environment; transmission; integration; investment and financing; cost; research and

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[93] http://www.hsr.ca.gov/Programs/Green_Practices/operations.html
[94] Before the CPUC, Southern California Edison Company's (U 338-E) Final 2012 Renewables Portfolio Standard Procurement Plan, Public Version, Rulemaking 11-05-005, November 29, 2012.
[95] *Clean Energy Jobs Plan*, Governor Jerry Brown, http://gov.ca.gov/docs/Clean_Energy_Plan.pdf.

development; environmental justice; local government coordination; and workforce development. The discussion below touches on some of these challenges.

The DRECP effort is identifying areas for development of renewable resources as well as for conservation and mitigation in the Mojave and Colorado Desert regions.[96] Once complete, the DRECP will offer an approach to addressing the challenges associated with planning, permitting and the environmental review process of renewable energy development in California. California's desert regions are attractive to renewable energy developers. As of April 2013, the CPUC had approved utility contracts with renewable projects in the DRECP area that are estimated to encompass roughly 130,000 acres.[97] The DRECP will provide for species and habitat conservation on a 22 million-acre swath of federal and private land, while accommodating the development of up to 20,000 MW of additional renewable energy generating and transmission capacity by 2040. The DRECP will provide for sufficient renewable energy development in the planning area to help achieve federal and state energy and climate goals, while also achieving conservation goals under the Natural Community Conservation Planning Act and federal Endangered Species Act.

Another example of challenges with recent trends in renewable development is the large portion of California's new RPS-eligible facilities that use photovoltaic energy without storage. A 2012 study by Lawrence Berkeley National Laboratory showed that as the use of solar resources increases, the system's net peak will shift to later in the evening when solar generation wanes. This ultimately reduces the value of solar without storage as it is not available to serve the evening peak load,[98] and analysis by California ISO shows that it leads to steeper ramp requirements to meet the evening peak (see Renewable Energy Integration section, Figure 4). Going forward, a more balanced portfolio will be needed to displace the use of fossil fuel for a broader set of energy services, including baseload, load-following, and peaking electricity.

Increasing amounts of wind and solar resources without on-site storage are requiring changes in grid operation and infrastructure to integrate growing amounts of variable generation (see discussion of Renewable Energy Integration below). The GHG benefits of increased renewable energy will vary depending on how well generation matches demand and the extent to which gas-fired electricity generation is needed. Going forward, California may encounter an upper bound on the amount of variable generation that can be accommodated by geographic diversity, demand response, improved

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[96] http://www.drecp.org/.

[97] Estimates prepared for the DRECP, Capacity is from the CPUC's RPS Project Status Table (March 2013) available at: http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm. Assumes 7 acres/MW for solar, 40 acres/MW for wind.

[98] Andrew Mills and Ryan Wiser, June 2012, Changes in the Economic Value of Variable Generation at High Penetration Levels: A Pilot Case Study of California. http://emp.lbl.gov/sites/all/files/lbnl-5445e.pdf.

forecasting, and other non-GHG integration services needed to maintain system reliability and maximize GHG benefits.[99]

Disadvantaged communities often look to the potential benefits of renewable energy in terms of air quality and job creation. While renewable generation is a tool to provide broad air quality benefits, it does not, however, necessarily displace local fossil plants. Power plants that provide local reliability services and support the grid must continue to operate, and so adding renewable energy locally may actually displace fossil generation located many miles away.[100] Also there is currently a lack of "green collar" employment opportunities and renewable projects in disadvantaged communities in urban and rural areas. Further deployment of renewable technologies and energy efficiency upgrades in such areas can help increase employment opportunities.[101]

Renewable Energy Generation Recommendations

Increasing renewable energy will require changes in the procurement and planning processes to ensure that the mix of renewable energy resources provides high value to California's electricity system. Below are highlighted recommendations from the *2012 IEPR Update*:[102]

- California's electricity planning efforts need to improve and expand. Energy planning is not simply a question of engineering and how to plan for and integrate more renewable resources. It must also addresses economic and equity issues that will require increased involvement by a large and diverse group of stakeholders. Actions to maximize the benefits of renewable energy must include modifying procurement practices to develop a higher-value portfolio that includes not just lower-cost projects but also those that provide integration services, encourage investment in disadvantaged communities, create jobs in California, and provide value to the state as a whole. Long-term planning must also provide the policy certainty needed by the market to encourage new investments and focus future investments in clean technology innovation.

- There are major planning challenges associated with moving from a generating fleet largely composed of dispatchable resources, which can be ramped up or

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[99] Kyle Siler-Evans, Inês Lima Azevedo, M. Granger Morgan, and Jay Apt; Regional Variations in the Health, Environmental, and Climate Benefits of Wind and Solar Generation; PNAS 2013 110 (29) 11768-11773.

[100] Transcript of Energy Commission Lead Commissioner Workshop on Evaluating and Capturing Benefits of Renewable Energy for California, April 12, 2012, comments by Arne Olson, Energy and Environmental Economics, pp. 26-27.

[101] California Energy Commission, 2012. *2012 Integrated Energy Policy Report Update*. Publication Number: CEC-100-2012-001-CMF. http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf

[102] California Energy Commission, 2012. *2012 Integrated Energy Policy Report Update*. Publication Number: CEC-100-2012-001-CMF. http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf

turned off on demand, to one that includes large amounts of variable renewable resources that cannot. Integrating these resources will require a combination of complementary resources, as discussed in the Renewable Energy Integration section below.

- California must address how to fund clean energy investments. The state will need to leverage federal tax credits, federal and private funding, and build on investments made through utility procurement programs, the ARRA, and the private sector. Funding for renewable energy and efficiency projects is expected to be available as a result of Proposition 39, and other funding sources such as cap-and-trade proceeds may provide additional opportunities.
- Cutting-edge RD&D is needed to produce the next generation of clean energy technologies. Targeted research and development can reduce the costs and environmental impacts of renewable technologies, help create new businesses and jobs, and attract investment capital to the state. To continue this work, implementation of the EPIC program is imperative.
- As California works to achieve its renewable energy goals, its actions must send appropriate price signals to help shape investments and influence behavior. At the same time, rate design must be fair, sustainable, and include mitigation measures for those who are disadvantaged. Actions should also lower the cost of renewables and reduce impacts on electric rates.
- California's energy system has disproportionately affected many of the state's disadvantaged communities, which may not be in line to receive many of the benefits of increasing renewable development throughout the state. Actions to promote renewable energy must also ensure that the costs and benefits of renewable development are fairly distributed.

Further action is needed to advance renewable energy, including:

- To help move toward an electricity system that primarily uses non-GHG emitting generation sources, the state should evaluate policies for ensuring continuing post-2020 reductions in the carbon intensity of electricity generation. Studies conducted should consider impacts on GHG emissions, as well as maximizing the value of renewable energy generation through cost-benefit assessments that include costs associated with integration, permitting, interconnection, and impacts on retail electricity rates.

Geothermal

Geothermal energy – heat from the Earth – comes from steam, water, or other hot underground fluid that is accessed by drilling wells in a process similar to drilling for oil. The hot fluid or steam is a carbon-free resource that can be used directly in heating applications, or can be converted into electricity by using steam to rotate a generating turbine. California has a unique abundance of geothermal resources that vary from low-temperature resources that can be used directly for district heating, aquaculture, and recreational uses to moderate- and high-temperature resources that can be used to produce electricity. With the exception of the Central Valley and the upper northwest

part of the state, geothermal resources and features, such as hot springs, have been found throughout California.[103]

Geothermal electrical production is generally located in or near areas with identified resources referred to as Known Geothermal Resource Areas (KGRAs).[104] KGRAs include the larger production areas at The Geysers KGRA in northern California, several KGRAs in Imperial County in southern California, and the Coso Hot Springs KGRA on the eastern side of the Sierra Nevada. The United States Geological Survey (USGS) estimates the mean electric power generation potential from the state's identified moderate-temperature[105] and high-temperature[106] geothermal resources to be 5,404 MW.[107] In addition, increased exploration and improvements in exploration and production technologies may yield significant additional electrical generation potential from undiscovered or unconventional geothermal resources, such as enhanced geothermal systems (EGS). The USGS has estimated the mean electric power generation potential from undiscovered resources in California to be 11,340 MW, with an additional 48,100 MW potential from EGS.[108]

With an installed geothermal capacity of 2,732 MW,[109] California currently leads both the nation and the world in the production of electricity from geothermal energy. Thirty-three additional geothermal electrical production projects (ranging from prospect development to resource production and power plant construction) are under development in California, with planned added capacity up to 1,061 MW and an estimated resource capacity of up to 1,827 MW.[110] Geothermal projects often need extensive resource exploration, characterization, and development work at the front end and can be very capital and time intensive, possibly taking several years at each development phase. However, if all of the existing thirty-three projects under development are successfully completed in the next 10-15 years, California could potentially reach more than 3,800 MW of installed geothermal electrical capacity by 2025-2030.

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[103] California Division of Oil, Gas, and Geothermal Resources, 2002. *Geothermal Map of California*, 2002. Map Number S-11. ftp://ftp.consrv.ca.gov/pub/oil/maps/Geothermal/MapS-11.pdf

[104] Title 14, Code of Federal Regulations, Section 3200. Definitions. "Known Geothermal Resource Area (KGRA) means an area where BLM determines that persons knowledgeable in geothermal development would spend money to develop geothermal resources".

[105] 90 to 150 degrees Celsius (C) [194 to 302 degrees Fahrenheit (F)]

[106] Greater than 150 degrees C (302 degrees F)

[107] United States Geological Survey, 2008. *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States*, 2008. Fact Sheet 2008-3082. Table 1. http://pubs.usgs.gov/fs/2008/3082/pdf/fs2008-3082.pdf

[108] Ibid.

[109] Geothermal Energy Association, 2013. *2013 Annual US Geothermal Power Production and Development Report*, April 2013, page 20. http://geo-energy.org/pdf/reports/2013AnnualUSGeothermalPowerProductionandDevelopmentReport_Final.pdf

[110] Ibid. Estimated resource capacity is the estimated amount of electricity recoverable from a geothermal resource, while the planned added capacity is an estimate of the portion of a geothermal resource that a developer plans to develop/use for electrical production.

In addition to the moderate-temperature and high-temperature resources suitable for electrical production, California has abundant lower temperature geothermal resources that could be used for small scale distributed generation and co-generation in connection with oil and gas[111,112] or mining operations, as well as for direct use applications and cascading, a practice where geothermal fluid is reused in a series of lower temperature applications.

In its Annual Energy Outlook 2013, the United States Energy Information Administration (EIA) estimated national renewable energy capacity growth from 2011 to 2040 based on oil and natural gas economics, market trends, regulatory influences, and a reference case developed for the assessment. EIA projected that nationally, geothermal capacity would more than triple from 2011 to 2040.[113] Although California currently leads the nation in geothermal capacity, development in other western states is accelerating and could account for a significant amount of the projected national growth in geothermal capacity. If economic and technical challenges can be overcome, however, California could develop significantly more geothermal electrical capacity from the estimated identified and undiscovered geothermal resources in the state. Imperial Irrigation District projects that the Salton Sea alone could have as much as 2,500 MW of economic geothermal potential.[114]

Geothermal Challenges

Geothermal power offers a number of operational benefits over variable energy resources such as wind and solar. With steady well production, geothermal plants can provide reliable power with highly efficient use of transmission capacity due to initial capacity factors ranging from 75 – 97 percent,[115,116,117,118] while binary geothermal plants can also provide flexible power and ancillary services by controlling the flow and pressure of fluids in the plant. Possible integration and ancillary services include

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[111] United States Department of Energy, 2012. *Geothermal Technologies Program Coproduction Factsheet*, DOE/EE-0699, February 2012. http://www1.eere.energy.gov/geothermal/pdfs/gtp_coproduction_factsheet.pdf

[112] Glassley, W.E., et al, 2013, *Geothermal Energy Potential from Oil Fields in the Los Angeles Basin and Co-Located Renewable Resources*, GRC Transactions, Vol. 37, 2013.

[113] U.S. Energy Information Administration, 2013. *Annual Energy Outlook 2013 with Projections to 2040*, April 2013. DOE/EIA-0383(2013), Page 74. http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf

[114] Imperial Irrigation District, *Salton Sea Revenue Potential Study – Final*, December 2013, http://www.iid.com/Modules/ShowDocument.aspx?documentid=8464.

[115] Richard, C., 2013. *Interpretation of U.S. Geothermal Industry Data Analysis of Capacity, Net Production, and Efficiency Trends: 2002-2011*. Page 639, GRC Transactions, Vol. 37, 2013.

[116] Kagel, A., et al, 2007. *A Guide to Geothermal Energy and the Environment*. Geothermal Energy Association, April 2007. Page 8, Table 1. http://geo-energy.org/reports/environmental%20guide.pdf

[117] International Energy Agency, 2010. Renewable Energy Essentials: Geothermal. http://www.iea.org/publications/freepublications/publication/Geothermal_Essentials.pdf

[118] U.S. Energy Information Administration, 2013. *Levelized Cost of New Generation Resources in the Annual Energy Outlook 2013*, January 2013. Page 4, Table 1. http://www.eia.gov/forecasts/aeo/er/pdf/electricity_generation.pdf

regulation up and down, spinning and non-spinning reserve, load following, and supplemental reserve.[119]

However, these benefits of geothermal power are not fully valued because the added costs of system integration, capacity, and ancillary services required by solar and wind are not included in renewable energy pricing for power purchase agreements. For example, under the 2011 RPS Solicitation, the CPUC required that a "zero" adder be used for integration costs in evaluating bids.[120] This, along with the large upfront capital costs for exploration and development, can make geothermal less attractive and competitive in the California energy market. Greater appreciation of geothermal energy's ancillary benefits may lead to better pricing of geothermal in power purchase agreements structured under the CPUC RPS Program. Furthermore, as discussed in the 2012 Integrated Energy Policy Report, integration costs (e.g. ramping, regulation) and capacity-related services provided by renewable resources are not included in the CPUC's procurement practices. This is problematic in that it prevents the procurement of a "least direct costs" portfolio. Actions to maximize the benefits of renewable energy include modifying procurement practices to develop a higher-value portfolio that includes not just lower-cost projects but also those that provide integration services, reduce the risk of forest fires that damage transmission lines, encourage investment in disadvantaged communities, create jobs in California, and provide value to the state as a whole.

Before executing power purchase agreements and starting power plant construction, geothermal developers must conduct resource exploration and development activities, including drilling exploration and production wells, to identify the characteristics and extent of the resource. These exploration and drilling activities are high-risk and represent a major capital cost for geothermal projects, requiring long lead times, expensive equipment, and technical expertise. The average cost for a single production well can range from $1-$5 million, depending on well depth and resource conditions.[121] High temperatures and corrosive geothermal steam and fluid conditions also require costly specialized materials for drilling and power plant construction. Improvements in non-drilling exploration technologies for resource assessment, such as geological, geophysical, and seismic survey methods, along with advances in drilling technologies and construction materials, can help reduce the costs associated with resource exploration, confirmation, and development.

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[119] Geothermal Energy Association, 2013. *The Values of Geothermal Energy: A Discussion of the Benefits Geothermal Power Provides to the Future U.S. Power System*, October 2013. Page 11. http://geo-energy.org/reports/Values%20of%20Geothermal%20Energy%20Draft%20Final.pdf

[120] California Public Utilities Commission, 2011. *Decision Conditionally Accepting 2011 Renewables Portfolio Standard Procurement Plans and Integrated Resource Plan Supplements*, Decision 11-04-030, April 14, 2011.

[121] Shevenell, L., 2012. *The Estimated Costs as a Function of Depth of Geothermal Development Wells Drilled in Nevada*. Page 126, Table 4, GRC Transactions, Vol. 36, 2012. http://www.atlasgeoinc.com/wp-content/uploads/Costs-GRC-2012.pdf

Lastly, increased exploration for undiscovered geothermal resources in the state would greatly expand resource use opportunities. Potential targets for exploration include areas outside of designated KGRAs with existing thermal features or conditions that may be consistent with geothermal systems and/or elevated subsurface temperatures.

Geothermal Recommendations

- The utilities and the CPUC should adopt changes to procurement practices for renewable energy generation such that procurement decisions consider an expanded suite of renewable energy benefits.
- Using geothermal power's potential as a flexible resource should be encouraged and its ancillary benefits to the grid should be recognized in power pricing agreements.
- Research is needed to further develop technologies and tools for remote sensing, surface, and downhole investigations and reservoir modeling to reduce the costs of geothermal exploration and development. Advances in materials engineering for high temperature and corrosion tolerant plant and well components can also reduce construction and maintenance costs. Innovative geothermal research, development, and demonstration projects in these areas should be supported with increased funding opportunities that can also leverage funding from other sources.
- Funding should also be provided for increased exploration to identify undiscovered geothermal resources.

Renewable Distributed Generation

Governor Brown set a target of adding 12,000 MW of renewable DG (20 MW or less) by 2020 as part of meeting the overall 33 percent RPS goal. The Energy Commission is tracking progress of the many programs in place that are helping the 12,000 MW by 2020 goal for renewable DG, including self-generation and wholesale renewable generation facilities 20 MW or smaller. In the IOU service territories, the following programs help achieve this goal: the CPUC's California Solar Initiative, Self Generation Incentive Program, and Renewable Auction Mechanism; the Energy Commission's New Solar Homes Partnership and Emerging Renewables Program (now closed); IOU solar projects; IOU feed-in tariff programs (AB 1969, SB 32, SB 1122); SCE Renewables Standard Contracts; and utility solar photovoltaic (PV) programs and RPS contracts for projects 20 MW or smaller. The following publicly-owned utility programs also help to achieve this goal: publicly-owned utility SB 1 programs; publicly-owned utility SB 32 feed-in tariff programs; and publicly-owned utility RPS contracts with projects 20 MW or smaller. As of August 2013, if all DG programs are fully subscribed by 2020, California will have more than 9,000 MW of renewable DG. If current programs succeed in transforming the market for renewable DG, much of the additional future capacity needed to achieve the goal could occur through market mechanisms.

As discussed in the Energy Efficiency section, DG is needed to meet the state's ZNE goals. To achieve ZNE, the amount of energy provided by on-site renewable energy sources equals the amount of energy used by the building over a typical year.

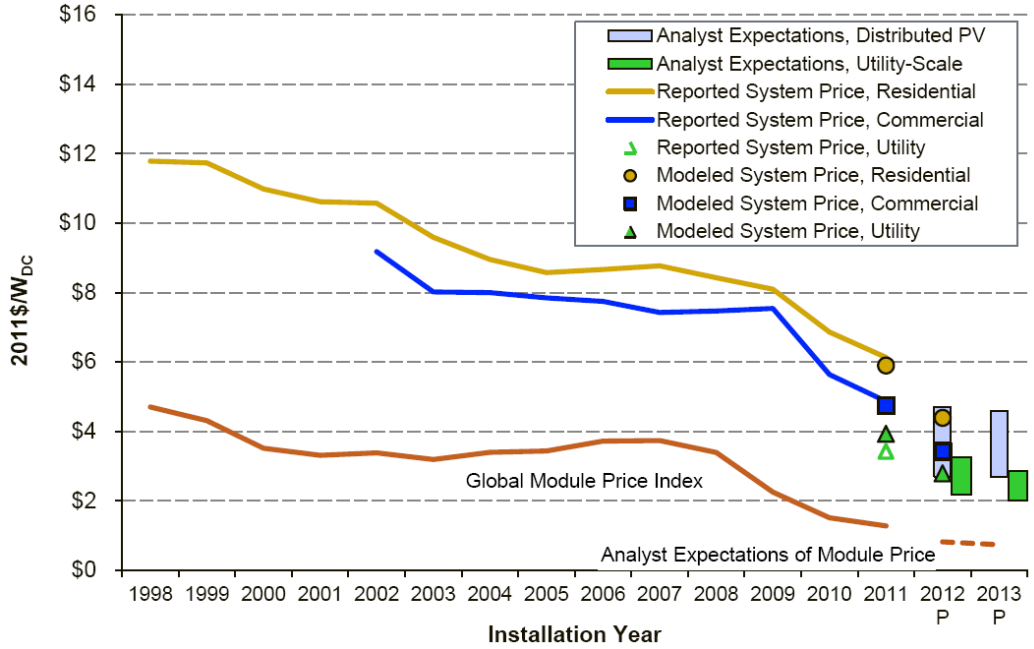
Currently, the pace of DG deployment on new homes is rapidly increasing as indicated by requests for New Solar Homes Partnership incentives. As new home construction in California emerges from the housing market crisis, the pace of requests for incentives from New Solar Homes Partnership is growing quickly. For example, the reservation amount dropped from about $27.9 million in 2008 to about $18.3 million in 2009 with the housing crisis. In 2010, it started to climb back up and in 2012, the reserved amount was almost $47 million.[122] If New Solar Homes Partnership activity in the first 2 months of 2013 continues, the Energy Commission would see reservation requests totaling approximately $75 million for the year.

PV costs have historically been high compared to other energy sources, but have sharply declined in recent years. A study by Bloomberg noted that in late 2011, prices for PV modules fell below the $1.00/W mark; moving towards the benchmark of $1.00/W installed cost for PV systems, which is often regarded in the PV industry as marking the achievement of grid parity for PV.[123] As shown in **Figure 3,** analysis at the U.S. DOE SunShot Initiative show declines in modules and system prices.

[122] http://www.gosolarcalifornia.ca.gov/about/nshp.php, last updated April 15, 2013.

[123]Morgan Bazilian, IjeomaOnyej, Michael Liebreich, Ian MacGill, Jennifer Chase, Jigar Shah, Dolf Gielen, Doug Arent, Doug Landfear, and Shi Zhengrong; Bloomberg Energy Finance; Re-considering the Economics of Photovoltaic Power; http://about.bnef.com/white-papers/re-considering-the-economics-of-photovoltaic-power-a-co-authored-white-paper-on-pv-economics/

Figure 3. U.S. DOE Sunshot: Historic, Recent, and Projected Photovoltaic Pricing Trends (November 2012)



Source: U.S. DOE, November 2012. SunShot: Photovoltaic (PV) Pricing Trends: Historical, Recent, and Near-Term Projections. http://www.nrel.gov/docs/fy13osti/56776.pdf.

Moving forward, California could choose to embrace a high renewable DG policy that supports a large number of communities choosing to pursue 100 percent RPS-eligible renewable targets. Such a pathway should be coupled with policies to develop a portfolio of technologies and renewable resources that provide distribution and transmission grid stabilizing services needed to maintain safety and reliability. For example, California already supports several projects that demonstrate the use of community scale DG to assist with renewable integration issues and grid reliability. The Energy Commission funded over twenty community renewable energy projects which demonstrate the cost-efficient integration of high-penetrations of renewable energy within a given community based on locally-available renewable energy potential. To the extent that systems are designed to provide self-generation only and store excess generation on-site, the impact of high levels of DG on California's distribution and transmission grids can be reduced.

Renewable Distributed Generation Challenges

Many of the challenges and recommendations discussed in the Renewable Energy Generation section also apply to renewable DG. A challenge unique to DG, however, is the need to modernize the distribution system to accommodate large volumes of DG. Meeting the Governor's goal of 12,000 MW of DG by 2020 requires the distribution system to be modernized and this need would increase if renewable DG policy targets are increased. A study by KEMA prepared for the Energy Commission examines experience in Germany and Spain to integrate large amounts of renewable DG and

identifies potential distribution system upgrades that may be needed in California.[124] A study by the Resnick Institute[125] looks at the challenges of maintaining grid stability, reliable energy supplies, and affordability as the energy system becomes increasingly more distributed with millions of new participants that will affect power supply and demand. Meanwhile, the grid is conveying increasing amounts of electricity from inherently intermittent and difficult to predict solar and wind resources. Possible electrification of the transportation and industrial sectors will further strain the distribution system.

A fundamental issue is that the distribution system was designed to move electricity in one direction: from central station power plants, through the transmission system, to substations, and finally to consumers. Changes and upgrades in both transmission and distribution infrastructure will be needed as concentrations of renewable DG increase, especially if the amount generated greatly exceeds minimum load at the local level or if the project is participating in a wholesale procurement program. New protection and control systems are required to avoid damaging the system in the event that DG exceeds local demand and flows backward into circuits or substations. The amount of upgrades needed will be affected by whether cost-effective storage options are available in conjunction with increasing levels of DG.

Updating legacy utility systems, however, will take time, planning, and financial investment. However, California's distribution system planning lacks transparency and is not well coordinated with other planning processes such as the Long Term Procurement Plan (LTPP), transmission planning, DG procurement programs, or smart grid deployment plans. This is expected to result in interconnection delays, lost opportunities to deploy DG strategically, and increased costs.

Similar to large-scale renewables, renewable DG creates integration challenges, as discussed below in the Renewable Energy Integration section. This is compounded by the fact that DG is not visible to the California ISO. As DG deployment increases, large daily swings in the net load (load minus intermittent generation) are expected with overgeneration during the day and a sharp drop at night when PV no longer produces energy. Also, fluctuations in PV generation output due to changes in cloud cover can appear as sudden additions or drops in load that need to be managed to maintain grid reliability. Looking to 2050, California will need a fully integrated smart grid enabling grid operators to monitor the distribution system in real-time using advanced sensors, system monitoring devices, and a well developed communication system.

Another way to accommodate high penetrations of DG is to develop self-generating, electrically isolatable microgrids. For example, the University of California, San Diego uses a microgrid and provides a demonstration site to test advances in DG and

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[124] Corfee, K., D. Korinek, C. Hewicker, M. Pereira Morgado, H. Ziegler, J. Zillmer and D. Hawkins, KEMA. 2011. *Distributed Generation in Europe*. California Energy Commission. Publication Number: CECV400V2011V011. Sacramento, Calif.

[125] Resnick Institute Report, Grid 2020 Towards a Policy of Renewable and Distributed Energy Resources, September 2012, http://www.gridwiseac.org/pdfs/grid_2020_resnick_report.pdf

communication and control management systems. The university's microgrid contains a portfolio of local energy demand and clean energy generation systems, including energy storage, electric vehicle charging, CHP, and various renewable technologies.[126] Other promising applications are facilities with very high reliability needs such as prisons, military bases, data centers, and remote locations, such as Borrego Springs.

Although PV cell costs have rapidly declined and PV is becoming increasingly cost-effective, the cost of interconnection to the distribution grid can be high. Similar to the challenge of interconnecting utility-scale renewable generation, the location of a renewable DG project can have a significant effect (negative or positive) on the cost and speed of both utility interconnection and local government permitting processes.

Electricity rate design is another concern related to costs. California's current residential tiered rate design – in which the per-kilowatt-hour rate increases in blocks as electricity consumption rises – is intended to drive efficiency but does not fully capture the fixed cost of providing electricity service. Most residential ratepayers do not understand the tiered block rates and block rates do not necessarily help low-income consumers.[127] Under current rate design, as energy efficiency and DG increase, more of the fixed costs will be spread amongst a smaller ratepayer base. The CPUC is currently exploring these issues in its proceeding, Rulemaking12-06-013.[128]

A related challenge is uncertainty around the continuation of net energy metering (NEM), a billing arrangement which allows customers who install solar PV and other RPS-eligible DG facilities to receive a credit for excess energy that is fed back to the utility. NEM enables customers to use the full output of variable DG technologies, such as solar PV facilities, without having to fully consume the system output in real time. Similarly, NEM supports the development of ZNE buildings. However, under NEM, utilities recover little or no fixed costs from residential customers. This is because, as discussed above, current rate design attempts to recover fixed costs through volumetric charges for residential customers. In October 2013, E3 provided a report to the legislature on these issues.[129]

Subsequently, rate reform legislation, Assembly Bill 327 (Perea, Chapter 611, Statutes of 2013), was signed by the Governor on October 7, 2013 that will have implications on

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[126] California Energy Commission, January 9, 2013, "Energy Commission Awards More than $1.8 million for UC San Diego microgrid Projects." http://www.energy.ca.gov/releases/2013_releases/2013-01-09_UCSD_nr.html.

[127] Transcript of Energy Commission Lead Commissioner Workshop on Retail Rate and Cost Issues with Renewable Development, May 22, 2012, comments by Severin Borenstein, UC Energy Institute, http://www.energy.ca.gov/2012_energypolicy/documents/2012-05-22_workshop/2012-05-22_transcript.pdf

[128] CPUC, *Order Instituting Rulemaking on the Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations,* Rulemaking 12-06-013, June 28, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/169782.PDF.

[129] http://www.ethree.com/documents/CSI/CPUC_NEM_Draft_Report_9-26-13.pdf.

NEM going forward and could affect any analysis of societal benefits. Among many other requirements, the bill extended the sunset date for NEM to July 1, 2017 and directed the CPUC no later than December 15, 2015 to develop a standard contract or tariff for customer generation projects. Implementation of these aspects of the bill may have implications of the cost-effectiveness of NEM as well as ratepayer costs and benefits.

Renewable Distributed Generation Recommendations

- The recommendations highlighted from the *2012 IEPR* Update in the Renewable Energy Generation section also apply to DG. Additionally, the *2012 IEPR Update* calls for building transparency into the distribution system planning. Distribution planning should integrate information on increasing quantities of DG while maintaining reliability, controlling costs, and reducing emissions.

Other actions needed include:

- Coming to a timely resolution and implementing reforms being addressed by the CPUC to "ensure that the interconnection process is timely, non-discriminatory, cost-effective, and transparent" (Rulemaking 11-09-011) are needed to help advance DG.
- The CPUC and the Energy Commission should work with the California ISO to determine what operational communication and control technologies are needed to provide greater visibility and respond to dispatch instructions from both the California ISO and utilities.
- The CPUC should ensure the timely implementation of AB 327 NEM requirements.

Renewable Energy Integration

As more variable renewable electricity generating resources like wind and solar are added to California's electricity resource mix, it becomes more challenging for the system operator to balance supply with demand and maintain reliability. Wind and solar output can rise or drop from moment to moment, across hours, and over days or months. Solar resources begin production after sunrise, peak in early afternoon, and more or less shut down at sunset. Wind patterns vary considerably over seasons and locations, but generation commonly peaks at night during the summer. While wind and solar have daily patterns that complement each other on average, actual production varies. A study by the Resnick Institute highlights critical engineering, economic, and policy issues that must be addressed to ensure a successful transition to an electrical system in which renewable and DG are increasingly deployed.[130]

[130] Resnick Institute Report, Grid 2020 Towards a Policy of Renewable and Distributed Energy Resources, September 2012, http://www.gridwiseac.org/pdfs/grid_2020_resnick_report.pdf

Currently, natural gas fired and hydroelectric power plants are the primary mechanism for integrating renewable resources to match supply and demand in real time. Assembly Bill 1257 (Bocanegra, Chapter 749, Statutes of 2013) requires the Energy Commission to determine the role of natural gas-fired generation as part of a resource portfolio, identify strategies and options to take advantage of natural gas as a low-emission resources, and optimize the role of natural gas as a flexible and convenient end use energy source. As part of that analysis, the Energy Commission is required to do a life-cycle GHG emissions study of the natural gas sector every four years. The 2015 Integrated Energy Policy Report will include this analysis. By 2050, the state should only use natural gas to integrate renewable resources, when it is coupled with CCUS. Currently gas resources typically have more than 300 starts and stops per year and operate about 40% of the time. Over time there are likely to be more start-ups and less overall operational. Renewable developers of geothermal and biomass should strive to design their facilities to compete economically in providing these services rather than only functioning as a baseload operation.

Maintaining reliable operation of the electricity system with a high level of intermittent resources will require integration services including regulation to follow real-time ups and downs in renewable generation, voltage, or frequency; ramping generation to follow swings in wind or solar output; spinning reserves that are standing by and ready to connect to the grid; replacement power for outages; and strategies to deal with over-generation conditions. It will also require complementary fast-response generation, energy storage, and demand response that can be turned up and down as needed.

Another consideration is that the mix and distribution of resources in California's renewable energy portfolio will affect integration requirements. For example, the thermal inertia of the fluids in a solar thermal electric power plant allows the generator to avoid sudden drops in energy generation when there is cloud cover. Also, broad geographic placement of PV can help mitigate the need for integration services associated with central station PV.[131] Some renewable powered facilities – such as variable speed hydropower, geothermal energy, and dispatchable biopower generation – can provide load following services, although the economics have not been favorable to date (and biomass supply is likely to be limited by increasing demand in the transportation sector). Another option is to curtail generation at times of overgeneration, but this has not been pursued thus far because it would put project financing at risk. Also, technologies can effectively be co-located to provide integration benefits as demonstrated in Braedstrup, Denmark. Although a potentially costly example, the city combined a solar thermal heating with a CHP plant, a borehole geothermal heat pump, and an electric boiler to provide district heating. The combination allows the district heating system to help integrate intermittent wind energy resources and stabilize the grid.[132]

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[131] Mills, Andrew and Ryan Wiser, Ernest Orlando Lawrence Berkeley National Laboratory, *Changes in the Economic Value of Variable Generation at High Penetration Levels: A Pilot Case Study of California,* June 2012, http://eetd.lbl.gov/EA/EMP.

[132] http://www.solar-district-heating.eu/NewsEvents/News/tabid/68/ArticleId/216/Braedstrup-Solar-Park-in-Denmark-is-now-a-reality.aspx.

Wide deployment of storage technologies, increased demand response, and expanded energy imbalance markets should be the primary mechanisms for meeting integration needs by 2050. Improved forecasting tools, and advancements in a smart grid will also help.

- **Storage:** While taking steps to minimize integration needs, the state must also advance energy storage technologies to help integrate increasing amounts of renewable resources. Storage technologies can be applied on the transmission and distribution system. Storage can help maintain a reliable and efficient transmission grid, providing voltage support to reduce flicker, frequency response by automatically injecting energy into the grid, and grid stability by supplying immediate energy to stop oscillations and improve grid dampening. Storage can also provide load-following capabilities to manage frequent and wide variations in solar and wind energy due to their fast ramp rates (MW power delivered per minute). Some storage technologies such as compressed air and pumped storage have higher ramp rates than conventional gas generation.[133] With smart inverters, storage can also potentially provide a service similar to inertia needed to maintain grid reliability that is currently provided with natural gas facilities.[134]

  Energy storage covers a wide range of emerging technologies, and while pilot project testing has been scaling up, pumped hydro is the only storage technology with extensive use in the field. Emerging storage technologies include flywheels, supercapacitors, batteries, and compressed air systems. Efforts are focused on putting more energy in a smaller package, at a lower price.

  Each energy storage technology has unique characteristics. Flywheels have historically been costly to install and have been used as "power devices", with high power output compared to energy capacity, resulting in brief discharge durations on the order of 15 minutes. Research is ongoing to produce flywheels with dramatically lower costs per kWh of energy capacity and with greater capacity to discharge over several hours. Supercapacitors have dramatically dropped in cost over the past decade and are an emerging energy storage technology capable of very high ramp rates, giving them a potential role in PV output stabilization. Batteries can have various chemistries and are typically capable of scaling up very cost-effectively, giving them a promising role in grid-level storage, but they have yet to be widely validated and verified for utilities. Conventional compressed air energy storage often requires underground caverns, limiting the technology's potential, but state of the art research is ongoing to create modular and more cost-effective aboveground systems.

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[133] 2011. *Renewable Power in California: Status and Issues*. California Energy Commission, December 2011, Publication No. CEC-150-2011-002-LCF-REV1.

[134] 2011. *Renewable Power in California: Status and Issues*. California Energy Commission, December 2011, Publication No. CEC-150-2011-002-LCF-REV1.

Vehicle-to-grid is another important storage option. Vehicle-to-grid applications allow for the bidirectional flow of electricity between plug-in electric vehicles (PEVs) and the grid, introducing the possibility of using PEV batteries as energy storage. With the development of vehicle-to-grid communications, PEVs can absorb energy during times of low demand or over generation and can then provide energy stored in the vehicle battery back into the grid during times of peak demand or when the grid is stressed. This application will benefit both utilities and vehicle owners as grid operators can use the PEVs as a resource to manage and stabilize the grid, while providing PEV owners the ability to sell electricity back to the grid, effectively reducing the cost of owning an electric vehicle.

The 2009 study by E3[135] suggested that an additional 12,000 MW of storage would be needed for a high renewable case with 74 percent renewable generation, 6 percent nuclear, and 20 percent other (including large hydropower, natural gas, and unspecified imports). Even with a high CCUS scenario (47 percent CCUS, 7 percent nuclear, 36 percent renewable, 10 percent other), the authors roughly estimate that 8,000 MW of storage would be needed, with more storage required if higher amounts of renewable energy comes online. California currently has about 1,200 MW of storage on line.[136] In October 2013, the CPUC adopted an energy storage procurement framework and design program which requires the IOUs to procure 1,325 MW of energy storage by 2024.[137]

- **Demand Response:** Currently, the utilities' demand response programs are included in the retail market but do not directly participate in the wholesale market through which the California ISO manages the grid. The programs also lack specific geographic presence targeted to locational needs, and are not visible or dispatchable by the California ISO. Such qualities are necessary to provide integration services.

  Demand response can best facilitate renewable integration via flexible, fast-response automated load control, auto-DR. Flexible demand response has the potential to displace the fossil generation that would otherwise be needed to maintain grid stability as a greater portion of generation is provided by renewable resources. The Energy Commission's research has demonstrated the technical feasibility of using auto-DR to maintain grid power quality at costs lower than traditional generation. Existing retail demand response programs are not designed to meet intermittent resource balancing needs and new flexible, fast-responding demand response programs must be designed and implemented.

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[135] E3, November 2009, *Meeting California's Long-Term Greenhouse Gas Reduction Goals*, http://ethree.com/public_projects/greenhouse_gas_reduction.html.

[136] 2011. *Renewable Power in California: Status and Issues*. California Energy Commission, December 2011, Publication No. CEC-150-2011-002-LCF-REV1.

[137] CPUC; Decision Adopting Energy Storage Procurement Framework and Design Program, October 17, 2013; http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M078/K912/78912194.PDF.

- **Energy Imbalanced Market:** A proposed energy imbalance market (EIM) between the California ISO, PacifiCorp, and NV Energy will help advance renewable integration and has a target implementation date of October 2014. The benefits of an EIM include dispatching energy every five minutes, providing real-time visibility across all balancing authorities, balancing load and resources in real-time with least cost generation, avoiding congestion, and taking advantage of geographical diversity of load and resources. Upon successful implementation of the EIM, the California ISO plans to offer EIM to additional participants throughout the West.
- **Forecasting:** Another mechanism for integrating renewable electricity generation is improved weather and operational forecasting tools. High-accuracy forecasting and modeling of intermittent PV and wind, especially for large power plant installations, will be a necessary tool for grid operators to minimize the operating reserves and standby capacity needed to ensure grid stability. Improved forecasting models will help to alert grid operators of upcoming ramp events, or sudden increases or decreases in energy production. In combination with widely-deployed energy storage, demand response, and fast-ramping natural gas power plants, state-of-the-art PV and wind forecasting could be a useful tool to integrate renewables into the California grid at the lowest cost.[138]
- **Smart Grid**: Finally, widespread deployment of a smart grid is needed to integrate increasing amounts of renewable DG. "Smart grid" refers to a distribution system that allows information from a customer's meter to flow in two directions: both inside the house to thermostats, appliances, and other devices, and from the house back to the utility. Smart grid can include a variety of operational and energy measures like smart meters, smart appliances, renewable energy resources, energy efficiency resources, demand response, and energy storage.[139] A smart grid can help coordinate renewable generation and storage on the supply-side with demand response for customer loads, increasing the value of each of these services.

Renewable Energy Integration Challenges

The surge in renewable generation with variable production profiles will accelerate through 2017, including as much as 7,000 MW of variable central station resources and a significant share of the 8,700 MW of DG needed to reach the State's goal of 12,000 MW by 2020. A majority of these resource additions will be solar photovoltaic which typically is a resource that peaks at noon. Intermittent renewable resources that increase the minute-to-minute and hourly variability of the electric system require more ancillary services and ramping capabilities for the grid to operate reliably. **Figure 4** demonstrates how renewable resource additions beginning in the 2013 – 2014 timeframe will significantly change the net load curve that the California ISO will be

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[138] National Renewable Energy Laboratory. May 2010. *Western Wind and Solar Integration Study*. Prepared by: GE Energy. NREL/SR-550-47434.

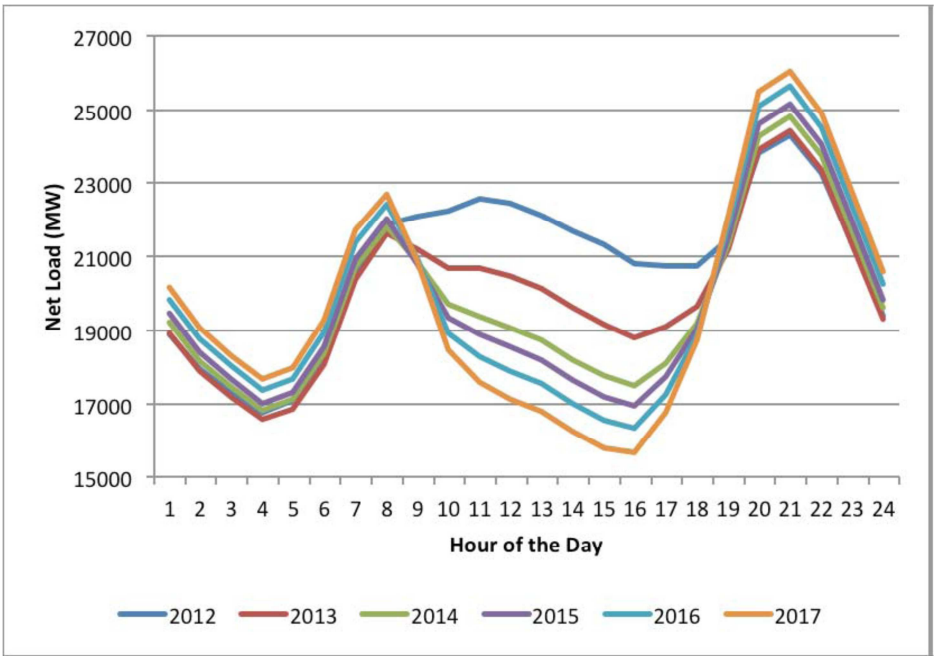
[139] 2011. *Renewable Power in California: Status and Issues*. California Energy Commission, December 2011, Publication No. CEC-150-2011-002-LCF-REV1.

managing.[140] A net load curve is constructed by subtracting the intermittent renewable – wind and solar – from the loads of the entire system. The California ISO's balancing authority will have a very different net load curve by as soon as 2014 because of the large amounts of solar being added. **Figure 4** shows for a particular day in March that the late afternoon ramp will increase much faster than the existing morning ramp. It is possible that over-generation will occur even at times when demand is high because the output of renewable generation is not well correlated with the shape of the load for all seasons of the year. For example, solar photovoltaic production peaks at noon and in March declines rapidly in the late afternoon, while the system is peaking later in the evening from 8:00 – 9:00 PM. Since most renewables have been contracted on a "must take" basis and generally are not curtailed, the electricity system may not have enough ramp down capacity to compensate for the energy produced during the middle of the day from solar resources. This would lead to over generation during the late morning and early afternoon hours. Many expect the non-renewable resources in the system will require more flexibility to compensate for the presence of large amounts of solar production and the variability of wind generation. Flexibility implies dispatchible resources that can meet short but steep load ramps, frequent starts and stops to address intra-hour variability, and increased requirements for regulation services.

Effectively integrating large proportions of renewable resources include simultaneously pursuing several potential solutions: (1) dramatically increased deployment of energy storage technologies that meet integration needs, (2) advanced demand response, (3) additional energy efficiency to reduce loads selectively during the day, (4) improved forecasting of loads and intermittent power production, and (5) advanced development of the smart grid to address system balancing at the distribution system level. Integrating intermittent resources also requires increased operational flexibility and market mechanisms that align with new operating requirements to ensure that enough fast-response and flexible resources are available.

[140] California Independent System Operator, February 26, 2013, *Comprehensive Forward Capacity Procurement Framework.*

Figure 4. Illustrative Change in Net Load Curve Using Load Shapes and Production Profiles From 3/22/2013



Source: California Energy Commission, Electricity Supply and Analysis Division (ESAD).

The current barriers to the deployment of energy storage primarily relate to cost, a need for a market for energy storage products, and lack of operational experience with many energy storage technologies. Energy storage could be a major game changer, but significant scientific breakthroughs are still needed to achieve the crucial very high ramp rates and long discharge times. As additional research is funded, pilots are conducted, and the market shakes out over the next several years, the optimal type, timing and placement of various storage technologies will become clearer. Some may be small-scale and associated with DG, while others may be coupled with specific generation sources or generally on the grid. Energy storage will need regulatory/market design intervention to help new battery technologies achieve commercial deployment.

Deployment of demand response to provide load balancing services at scale will require a sustained effort to develop the necessary policies and markets along with customer engagement on a much greater scale than has been achieved historically. A challenge to using demand response for integration services is making the changes needed for California's demand response programs to meet the California ISO's standards for reliability products and be able to participate in the California ISO's wholesale markets. The necessary advanced metering has largely been deployed, but further work is needed to deploy technologies that enable the California ISO to control energy use. Widespread use of auto-DR technology is likely to be essential to success, but adequate pricing will be needed to achieve customer acceptance.

Other challenges include the need for fully dynamic residential rates in which costs vary minute by minute or hourly. Dynamic pricing opportunities lag under the AB 1X (Keeley, Chapter 4, Statutes of 2001) legislative constraints on residential rate design, a lack of consensus on how the rates should be applied to residential customers, complexities of utility rate cases, and difficulty in attracting non-residential customers to current rate offerings. Further customer education about all aspects of demand response programs is needed as well as additional information about what will motivate mass market participation in demand response opportunities.

A challenge for improved forecasting is that a number of differing forecasting models are used to predict performance on discrete timescales: minutes ahead, hours ahead, and days ahead. Challenges include integrating forecasting tools and achieving higher spatial and temporal resolution to better predict performance of intermittent renewable resources across all timescales.

While the discussion above focuses on utility-scale renewables, renewable DG poses many of the same load balancing challenges as discussed in the section on Renewable Distributed Generation Challenges. While planning and building has been underway to construct the wires, poles and substations for transmission needed for central station generation, solutions are less advanced on the distribution side. Deployment of a smart grid that is electronically and digitally able to communicate and optimize electricity generation, transmission, distribution, and customer systems is needed.

Renewable Energy Integration Recommendations

The volume of variable energy generation development, largely solar, expected over the next decade creates a number of challenges that can be addressed by measures outlined below:

- Develop a forward procurement mechanism to provide flexible, dispatchable generation resources including natural-gas or biomethane-fired generation, that can ramp up and down quickly and often. Fully leverage demand response, energy storage, and other distributed technologies by designing market mechanisms that allow these resources to compete on a level playing field to provide integration services.[141]
- Expand participation of regional balancing authorities in the California ISO/PacificCorp Energy Imbalance Market, which provides a low cost, low risk means of achieving operational efficiency and flexibility needed for greater penetration of intermittent renewable resources. By providing frequent and automatic dispatching of the diversity of loads and resources across the entire Western region, an EIM allows integration of higher levels of wind and solar resources.

[141] California Energy Commission, 2012. *2012 Integrated Energy Policy Report Update*. Publication Number: CEC-100-2012-001-CMF. http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf

- Implement storage procurement targets adopted by the CPUC in October 2013 to encourage the cost-effective deployment of energy storage, consistent with Assembly Bill 2514 (Skinner, Chapter 469, Statutes of 2010).
- Advance RD&D to maintain reliability and cost-effectively integrate increasing solar, wind, and other renewable energy generation. In particular, RD&D is needed for energy storage on a state and federal level. Research should also include improvement of forecasting capabilities and models for solar and wind, expansion of smart grid technologies, and development of microgrids.

Bioenergy

Biomass can be used for various energy applications, including transportation fuels, heat production, and electricity generation. "Bioenergy" is the general term for energy produced from biomass and includes electricity (biopower), renewable gas (biogas, biomethane, or synthetic natural gas), and liquid transportation fuels (biofuels). Biomass sources include California's agricultural, forest, and urban waste streams. Bioenergy can provide a pathway to low-carbon fuels that can directly replace fossil fuels in California's existing infrastructure.

A report by the California Council of Science and Technology[142] found that substantial amounts of low-carbon biofuels are required to meet 2050 GHG reduction goals, even with optimistic efficiency, electrification, and implementation of other renewable energy sources. The study found that gaseous biofuels will be required for some heavy industry and for integrating intermittent electricity generation from renewable sources such as wind and solar.

The use of biomass residues benefits a wide range of stakeholders including farms, dairies, forestry, food processors, public works, and waste management. Benefits include reductions in business costs, community waste, local pollution, wildfire risk, and fossil GHG emissions. These benefits vary depending on location and biomass resource type.

Traditionally, biopower was dominated by existing solid-fuel biomass facilities. In the last few years, biopower provided about 30 percent of the renewable electricity generated in California, but many of these facilities became economically unsustainable with the decline of the timber industry in California and many have shut down. Operating capacity for solid-fuel biomass peaked in 1990 at about 800 MW[143] and there is currently about 650 MW still in operation.[144] The next generation for using solid-fuel biomass is thermochemical conversion technologies that produce a methane and hydrogen rich gas which can then be used to generate electricity or offset on-site

[142] Youngs, Heather and Somerville, Christopher R., California Council on Science and Technology, California's Energy Future – the Potential for Biofuels, May 2013.

[143] http://www.nrel.gov/docs/fy01osti/28805.pdf.

[144] California Energy Commission QFER database, ERFP database, and staff outreach to facility operators. Does not include capacity from in-state coal facilities co-firing with biomass. No data is available on actual biomass capacity at these facilities.

propane use. Currently there are only three known projects operating in California, all under 1 MW. However, the next generation of in-state biopower facilities could provide significant amounts of dispatchable capacity if local distribution challenges can be overcome.

However, new biogas-to-power projects continue to be developed.[145] Biogas is a flexible energy resource that can be used as a direct replacement for natural gas or propane in electricity, transportation, and heating applications.[146] Conditioned biogas, or biomethane, that is cleaned to pipeline quality requirements can be delivered through existing utility natural gas pipelines for use in existing residential or industrial appliances, to generate electricity, or as a transportation fuel.

In the future, micro-sized anaerobic digester technologies could be integrated into homes, or more likely multifamily dwellings, to produce biogas from food, human, and some green wastes onsite. This gas could then be used to operate gas appliances such as water heaters, furnaces, or fuel cells. Gas clean-up technologies are not yet commercially viable for on-site end-use applications.

Although debate continues on the most efficient and beneficial use of biomass, in the short term the most economically and technically viable use may be biopower production. In most cases, the greatest GHG benefit may come from using biomass in CHP applications to produce electricity and heat. However, CHP applications may not exist within a reasonable distance from biomass resources. Biofuel demand is also growing, although in remote areas it can be challenging to find an off-taker for transportation biofuels.

In the long term, demand for alternative transportation fuels could greatly increase with conversion of biomass to liquid fuels for transportation applications likely to outpace demand for electricity generation. Given short and long-term bioenergy demand and the ability of processed biogas to offset natural gas use in both the electrical and transportation sectors, state policy has placed a priority on actions to promote development of sustainable biogas production facilities.[147]

Bioenergy Challenges

Although biopower has been a large part of California's renewable supply, its potential to provide sustainable renewable energy is limited by available feedstocks.[148] With

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[145] Energy Commission staff analysis of data compiled from the U.S. EPA Landfill Methane Outreach Program and the Energy Commission's QFER database. Biogas is a methane rich gas produced from the thermochemical or biochemical conversion of biomass. Generally, projects include anaerobic digester and landfill gas projects.

[146] Some applications require treatment to remove moisture, carbon dioxide, and other contaminants.

[147] *2012 Bioenergy Action Plan.* http://www.resources.ca.gov/docs/2012_Bioenergy_Action_Plan.pdf.

[148] This is also true for the carbon benefit of a biomass resource. If the biomass is harvested from a forest specifically for bioenergy production, there is a long-term temporal shift in when the carbon benefit will be realized. Some estimates range from 30 years to over 100 years. Biomass resources that are residuals

California's emphasis on low-carbon transportation fuels and renewable energy, the state must develop criteria that ensure biomass use in California continues to be sustainable and beneficial. Guidelines, such as the sustainability standards developed for the Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program,[149] will be necessary to ensure biomass collection is sustainable into the future and to preserve the GHG benefit of the resource.

Because of competing needs for biomass in electricity, transportation, and other applications, the state may need to explore the development of bioenergy crops to generate biomass. Energy crops play an important role in developing low-carbon biofuels but can have life cycle impacts such as water use, land use changes, and loss of food production which can affect a feedstock's overall GHG reduction value. Consistent with the *2012 IEPR Update* recommendation to identify priority renewable energy development zones in California, consideration should be given to the effects of development on the environment and electrical system, areas with high unemployment, and disadvantaged communities that are identified by Cal/EPA as required by Senate Bill 535 (De León, Chapter 830, Statutes of 2012).[150] In the case of production of biofuels from algae, co-location with existing facilities that emit CO_2 would be ideal.

Biogas upgraded to biomethane can be a direct replacement for natural gas, with the most efficient means of transport being through utility natural gas pipelines. However, there are many technical and economic challenges that must be addressed to achieve commercial development of this resource in California. Technical challenges include lack of commercialized biogas cleanup technologies and unknown biogas quality standards.[151] Economic challenges include distance of biomass resources to pipeline infrastructure, the dispersed nature of biomass,[152] and the lack of a fully commercialized biogas industry.

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from other processes such as milling or food processing have carbon benefits that are accrued quickly because the carbon stored in the living matter was going to be released into the atmosphere anyway.

[149] Muench, Tobias. Final Regulation Language Alternative and Renewable Fuels and Technologies Program Title 12 California Code of Regulations Sections 3100--3108, Regulations, California Energy Commission, Publication Number CEC-600-2008-013-F, April 2009.

[150] Senate Bill 535 requires the Cal/EPA to identify disadvantaged communities, "…based on geographic, socioeconomic, public health, and environmental hazard criteria, and may include, but are not limited to, either of the following: (a) Areas disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation. (b) Areas with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment.

[151] These standards are currently under development by the CPUC under Rulemaking 13-02-008.

[152] In most cases, biomass resources cannot support the development of a large facility without transporting material great distances. This increases the cost of the resource and diminishes the economic feasibility of the project. Small facilities are expensive because current technologies and deployment techniques do not scale down economically.

Bioenergy Recommendations

- Solving the cost allocation challenge for biomass collection and distribution will require development of non-ratepayer-funded mechanisms to mobilize sustainably available sources of biomass feedstock. Various agencies in the Bioenergy Interagency Working Group would play a role, including, California Department of Forestry and Fire Protection, ARB, CalRecycle, and the Natural Resources Agency.
- Biomass goals should continue to be aggressive but also consider sustainable biomass yield, greenhouse gas impacts, reduction of climate risk and increased forest health and resilience, waste reduction, air and water quality benefits, recycling, composing, and environmental protection. Various agencies in the Bioenergy Interagency Working Group would play a role, including California Department of Forestry and Fire Protection, ARB, CalRecycle, and the Natural Resources Agency.

- Further work is needed to analyze existing state and federal forest and wildland protections to ensure that biomass use will not increase net long-term GHG emissions. Building on the recommendation in the *2012 Bioenergy Action Plan* to establish sustainability standards for forest biomass feedstock, the state should develop a uniform state sustainable forest-biomass usage policy.

- The Bioenergy Interagency Working Group should identify an appropriate funding source for developing a statewide programmatic Environmental Impact Report for thermochemical conversion technologies using biomass. The Environmental Impact Report should focus on streamlining the environmental review process for SB 1122-type projects.

- Consistent with the recommendation in the *2012 IEPR Update*, the CPUC should modify procurement practices to develop a higher-value portfolio. Procurement decisions should consider an expanded suite of renewable energy benefits, including RPS-eligible facilities that can provide dispatchable and reliable power, integration benefits, reduction in forest fires that threaten public health and safety and damage transmission lines, reduction in transmission and distribution costs, increased investment in disadvantaged communities, and creation of green jobs.

- The Energy Commission should continue research, development, and demonstration of biogas-to-biomethane technologies and projects that inject biomethane into California's natural gas pipelines. The priority should be research that provides needed data identifying constituents of concern for additional feedstock sources not identified in the ARB and Office of Environmental Health Hazard Assessment staff report *Recommendations to the California Public Utilities Commission Regarding Health Protective Standards for the Injection of Biogas into the Common Carrier Pipeline*.[153] Second, the Energy

[153] http://www.arb.ca.gov/energy/biogas/biogas.htm.

Commission should fund research and development of small-scale biogas conditioning technologies.

Solar Space and Water Heating

For electric space and water heating, the state supports solar thermal applications as an alternative to electricity. Solar thermal applications are more environmentally appropriate and less expensive than using electricity to heat space or water. Solar space heating is passive solar and has been a key part of California's building codes since their inception in 1978. Another example of state support is the CPUC's CSI-Thermal Program launched in 2010 to provide rebates to IOU customers who install solar thermal systems to replace water-heating systems powered by electricity or natural gas. The CPUC allocated $350.8 million to advance solar water heating through direct financial incentives to retail customers, training for installers and building inspectors, and a statewide marketing campaign.[154] Solar thermal technology applications include residential and commercial hot water applications as well as industrial heating applications, including food processing[155] and enhanced oil recovery.

Similarly, geothermal or ground source heat pumps offer opportunities to use the heat exchange capacity of the earth to increase the efficiency of heating and cooling systems. The technology uses the earth as a heat source in the winter and a heat sink in the summer and can be applied to residential and non-residential buildings. The Energy Commission, in consultation with the CPUC, cities, counties, special districts, and other stakeholders, evaluated the barriers and strategies of geothermal heat pump/ground loop technology as part of the *2013 IEPR*.

While many studies suggest industrial electrification and electrifying space and water heating as a necessary pathway to achieving the 2050 GHG reduction goal, solar thermal provides a better option for serving heating needs. Further, the effort to nearly eliminate GHG emissions from the electricity sector will be compounded by electrifying sectors currently served with natural gas, whereas efforts to increase efficiency and renewable fuels in the gas sector will advance meeting the state's GHG reduction goals. To the extent that solar thermal can displace natural gas use for heating, it will reduce the need to shift heating load to the electricity sector.

Solar Space and Water Heating Challenges

Limited consumer acceptance hinders widespread application and use of solar space and water heating. There is a lack of consumer awareness about solar water heating (SWH) systems and their energy savings and environmental benefits. Solar space and water heating are not perceived as standard heating options. Also, there is a lack of awareness that the industry is mature with widely recognized uniform technology

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[154] http://www.cpuc.ca.gov/PUC/energy/Solar/swh/.

[155] Rebecca Milczarek, Ph.D , "Solar Thermal: Exploring the World's Oldest (and Newest) Food Processing Technology," Presented at the UC Solar Research Symposium in Davis, California. May 2, 2013.

standards. Consumers are concerned about installation quality, system performance, and ease of maintaining the system.

The economics are also a barrier, with high upfront costs and long paypack periods. Also, the installation and maintenance costs are higher than conventional heating systems.

Retrofitting existing buildings can be challenging as structural issues may prevent installation. Also, tree shading and obstructions on the roof (vents, package units, skylights, exhaust fans, chimneys, etc.) may impede installation, and roof installations may void roof warranties. Finally, efficiency is diminished when solar systems are not fully integrated with the design of the building or if not properly installed.

Rental buildings pose additional challenges to widespread deployment of solar thermal space and water heating. Similar to the difficulty with installing energy efficiency upgrades in rental buildings, the building owner typically does not pay the energy bills and has little incentive to pay the upfront costs to install an energy saving technology such as solar water heaters.

Finally, further technological innovation is needed. For example, there is a need to develop combined solar hot water/heating systems that are highly energy efficient, easy to operate and maintain, and are lower cost than maintaining and operating separate hot water and heating systems. Technology advancements are also needed to develop alternative materials, technologies and manufacturing techniques; make systems more modular; develop integration of solar collectors into building surfaces; and develop of collectors that cover a wider range of temperatures.

Solar Space and Water Heating Recommendations

- Continue rebates for SWH, space heating, and solar cooling applications to improve price competitiveness.
- Increase targeted marketing and outreach to increase consumer awareness and adoption of SWH and solar space heating.
- Increase efforts to develop better workforce training to help ensure proper installation, improve performance, and increase the number of qualified installers. Additional training and education is needed for architects, engineers, designers, building owners, facility managers, consultants, and installers.
- Further RD&D is needed to increase efficiency, performance, and reliability; lower manufacturing, installation, system, and maintenance costs; develop combined space and water heating systems; develop solar collectors that are integrated into building surfaces; and to better understand consumer behavior.

Natural Gas with Carbon Capture Utilization and Storage

The rapid development of renewable electric generation with intermittent output is increasingly displacing gas-fired generation, aside from where gas-fired generation is needed for integration and reliability services. Current natural gas facility designs are being adapted to serve an integration function, which means steeper ramping and multiple stops and starts (over 300 per year). All this must be accomplished within the strict parameters of criteria air pollutants regulations. Technology improvements and new market tariffs will be needed to encourage gas plants with the attributes most useful to California's grid.

If CCUS technology becomes cost-effective, natural gas units can become a de-carbonized resource. It is not clear when alternatives such as demand response, storage, or dispatchable renewable generation will become cost-effective and available on a large enough scale to provide low-carbon integration services. The ultimate aim, as discussed in the Renewable Energy Integration section of this working paper, is by 2050 to use natural gas coupled with CCUS to integrate renewable resources and provide other reliability services.[156]

CCUS has the potential to reduce emissions throughout the electricity and transportation sectors. Projects should facilitate development of CO_2 storage verification methodologies (including options for utilization), promote new energy infrastructure development, and provide platforms for testing technology advances to address California's strategic priorities to lower costs for clean energy, save water, and assure sustainability and reliability of the electric grid and the state's natural resources.

A California Council on Science and Technology study[157] suggests that the 2050 GHG reduction goal cannot be met without widespread deployment of CCUS on stationary industrial sources with large CO_2 emissions, such as power plants and oil refineries. Attaining this scenario will require accelerating the rate of CCUS commercialization and market adoption over the next 35 years. However, as noted previously, the study does not consider solar for industrial applications of process heat and cooling.

CCUS research and projects worldwide indicate that CO_2 can be stored safely in the Earth's subsurface long enough to address CO_2 reduction goals. CCUS research and development in California – funded for the last decade by the U.S. DOE (through the West Coast Regional Carbon Sequestration Partnership[158] and funds from ARRA) and by PIER programs – contributes to this assessment. Commercial-scale demonstration

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[156] "Utilization" refers to a policy of using excess CO2 in productive commercial applications that provide inherent storage of CO2 away from the atmosphere (for example, by binding it in a long-lived product such as a building material) first before storing whatever remaining CO2 that cannot be used economically.

[157] *California's Energy Future – The View to 2050: Summary Report*, California Council on Science and Technology, May 2011.

[158] WESTCARB was established in 2003 and is one of seven research partnerships co-funded by the U.S. Department of Energy to characterize regional carbon sequestration opportunities and conduct technology validation projects; http://www.westcarb.org/.

of CCUS on key California point sources such as natural gas combined cycle power plants, refineries, and cement plants, as well as utilization options such as CO_2-enhanced oil recovery, are a vital next step to gaining real-world experience specific to California.

The Hydrogen Energy California (HECA) project is a CCUS project in California undergoing permitting. The project is a planned integrated gasification combined cycle plant with production of hydrogen, electricity, urea-based fertilizer, and CO_2 for enhanced oil recovery (by agreement with Occidental Petroleum). In addition, the Calera Corporation is currently operating a pilot carbon capture facility adjacent to the Moss Landing natural gas-fired power plant in Monterey County. In capturing CO2 and other emissions from the power plant's flue gas, Calera's process uses a carbonate mineralization technology, resulting in a solid that can be sold as an aggregate or replace a portion of the cement in concrete blends.[159]

Infrastructure components for CCUS include CO_2 capture facilities at emission sources, pipelines for transport, and injection and monitoring wells at storage sites. CO_2 pipeline networks that connect regions with multiple large CO_2 sources with suitable storage or utilization sites are seen as the most cost-effective transportation option. Enabling pipeline construction may require state policies on rights-of-way acquisition, incentives, or other ways to encourage investment in CCUS project development.

Carbon Capture, Utilization, and Storage Challenges

One major policy challenge for CCUS is determining the transitional role of natural gas between now and 2050. Natural gas units are normally long-lived capital investments and can be kept running for thirty to forty years with proper maintenance. California's natural gas-fired plants have become more efficient over the past decade largely due to fleet turnover and produce more electricity per therm of gas. Plants can change functions over time, providing energy and balancing services in the first few years, then being used primarily as a source of capacity as they age. However, once the investment in a new natural gas facility is made, there is an economic interest in its continued operation and any new zero-carbon energy source must compete with it.[160]

For CCUS to support California's 2050 GHG reduction goal, a combination of technical and regulatory advances must occur at a steady pace over the next ten years. Cap-and-trade incentivizes CCUS investments at gas plants as a way to reduce or avoid the expense of purchasing offsets and allowances. As California reduces its future carbon cap, gas generation without CCUS will face ever increasing GHG offset and allowance costs. Additional demonstration and commercial projects for major types of industrial

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[159] http://www.arb.ca.gov/cc/etaac/meetings/102909pubmeet/mtgmaterials102909/basicsofcaleraprocess.pdf

[160] Harvy, Hal; Orr, Franklin Jr; Vondrich, Clara. *A Trillion Tons*. The American Academy of Arts & Sciences, 2013.

and natural gas power CO_2 point sources (either existing or newly built) in conjunction with a robust RD&D program will address both needs.

Another potential CCUS challenge is induced seismicity. CCUS involves injecting and storing fluid at very high pressure underground beneath a layer of caprock, which has the potential to generate or amplify seismic activity.[161] Induced seismicity could become a barrier to implementation of CCUS for two reasons—the risk of damage to people and property and the risk of fracturing the caprock thereby releasing the stored CO2. However, the level of risk is not well-known at this time.

New commercial-scale CCUS projects must be added annually over the next several decades to reduce GHG emissions to 80 million metric tons or less by 2050. At least 10 million metric tons of CO_2 emissions must be removed annually between 2030 and 2050 but with each year of delay in implementing GHG reduction technologies, the required removal rate increases. Given that commercial-scale power and industrial projects may take more than a decade to become operational, timely actions to assure deployment of CCUS technologies on a variety of emissions sources is imperative for California to stay on course for the 2050 goal.

Carbon Capture, Utilization, and Storage Recommendations

- Policy actions are needed in the near-term to incorporate CCUS into the portfolio of accepted compliance technologies – especially the development of accounting and regulatory methodologies – to promote a greater number of CCUS projects capable of achieving the substantive emissions reductions to meet 2050 goals. Policies that support a sustainable and predictable value for CO_2 and that clarify how storage and utilization fulfill compliance requirements are critical to enabling CCUS technologies. Policy and regulatory barriers and recommendations for solutions are discussed in detail in a 2010 report by the California Carbon Capture and Storage Review Panel.[162]

Further RD&D is needed to:

- Facilitate a public/private partnership to demonstrate capture, utilization, and geologic storage of at least one hundred thousand tons per year of CO_2 as a GHG mitigation measure to verify regulatory frameworks and quantification methodologies.
- Demonstrate and validate the grid support co-benefits of operating CO_2 capture systems for natural gas power plants in a manner that maximizes the aggregate value of peak power production, spinning reserve capacity, and GHG emissions reduction.

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[161] National Research Council, Committee on Induced Seismicity Potential in Energy Technologies. 2013. Induced Seismicity Potential in Energy Technologies. The National Academies Press, Washington, DC. 300 pp.

[162] http://www.climatechange.ca.gov/carbon_capture_review_panel/documents/2011-01-14_CSS_Panel_Recommendations.pdf.

- Demonstrate the capabilities of new and emerging CO_2 capture technologies and utilization options that reduce costs; energy and water use; and provide economic benefits through new low-carbon products, such as plastics and building materials.
- Demonstrate and validate sustainable land management practices for forests, rangelands, wetlands, and agricultural lands that maximize the collective value of economic productivity, carbon storage, and wildfire control, while meeting goals for biodiversity and habitat preservation, soil conservation, and water quality.

Nuclear

Nuclear power is another potential option for producing electricity without generating GHGs, although nuclear power is not included in California's loading order and California law prohibits the construction of new nuclear facilities unless specific nuclear waste disposal requirements are met. In 1976, the California Legislature required that a new nuclear facility can only be permitted if the Energy Commission finds that the federal government has identified and approved a demonstrated technology for the:[163]

- Construction and operation of nuclear fuel rod reprocessing plants, and
- Permanent disposal of nuclear waste.

As neither of these conditions has been met, the law effectively created a moratorium on the construction of new nuclear power plants in California, and no new nuclear plants have been constructed in California in more than 30 years. The law exempted California's two existing nuclear facilities, Diablo Canyon Power Plant (Diablo Canyon) and San Onofre, from the new requirements.[164]

California's electricity mix uses nuclear energy from two facilities: Diablo Canyon in California and the Palo Verde in Arizona. California had also received nuclear power for over 40 years from San Onofre until it went offline in January 2012. In June 2013, SCE announced plans to permanently retire San Onofre.[165] Since San Onofre went offline, energy utilities and the state have worked to provide Southern California with reliable electric power and those efforts will continue. Nuclear power provided about 18 percent of California's in-state electricity generation in 2011, but this dropped by half to about 9 percent in 2012 with the outage of San Onofre (these figures do not include imported electricity).

The operating licenses for Diablo Canyon Power Plant (DCPP) Units 1 and 2 are set to expire in 2024 and 2025, respectively. Licenses to operate DCPP Units 1 and 2 would be extended until in 2044 and 2045, respectively, if approved by the NRC. Even if DCPP is relicensed for another 20 years to run until the mid 2040's, the aging power

[163] Legislative Analyst's Office, http://www.lao.ca.gov/ballot/2011/110306.aspx .

[164] Legislative Analyst's Office, http://www.lao.ca.gov/ballot/2011/110306.aspx .

[165] http://www.edison.com/pressroom/pr.asp?id=8143

plant will ultimately need to be retired. Diablo Canyon is not expected to be operating in 2050.

While the retirement of Diablo Canyon has limited implications for meeting local reliability needs[166], San Onofre was a key provider of reliability services in both the Los Angeles Basin and San Diego areas. Transmission upgrades, synchronous condensers, energy efficiency, demand response, and some conventional generation in Orange and San Diego Counties will contribute to replace San Onofre in the near term, providing reactive power and reducing the need for additional local capacity.[167] The amount of flexible, dispatchable capacity needed in the Los Angeles Basin to replace San Onofre and facilitate the system-wide integration of intermittent renewable resources is the subject of the CPUC's 2012 LTPP and Resource Adequacy proceedings. In addition, the California ISO's transmission planning process is looking into transmission options for replacing generation for San Onofre.

Nuclear Challenges

The *2011 IEPR* took a close look at nuclear power in California after the March 2011, earthquake and tsunami that knocked out power and emergency electrical equipment at the Fukushima Daiichi nuclear plant in Japan. Japan suffered a 9.0 magnitude earthquake, resulting in reactor meltdowns, explosions, fires, and widespread radioactive contamination. Although such a high magnitude quake and tsunami is not thought to be possible near Diablo Canyon or San Onofre, the Fukushima incident heightened concerns about seismic and tsunami hazards for California's coastal nuclear plants and nuclear plants worldwide.[168]

If breakthroughs are made to address a permanent solution to nuclear waste and if new facilities can be located in seismically safe areas, new nuclear facilities may be constructed in the 2030 or 2050 timeframes to meet California's electricity needs. However, even if these tall hurdles are overcome, the state will still need other resources to address load balancing needs. Nuclear power plants have very slow start up periods, little operational flexibility, and significant reliability consequences when they trip off line. Heavy reliance on nuclear would likely require comparable amounts of storage and flexible units.

Nuclear Recommendations

- The Energy Commission as coordinator of the High-Level Nuclear Waste Repository Technical Advisory Group on Yucca Mountain, should continue to

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[166] 2012-2013 Transmission Plan, California ISO http://www.caiso.com/Documents/BoardApproved2012-2013TransmissionPlan.pdf.

[167] For Summer 2013 efforts to mitigate the impact of the absence of San Onofre, see "Briefing on Summer 2013 Outlook and Update on SONGS Mitigation Planning," presentation to the California ISO Board of Governors Meeting, March 20-21, 2013.

[168] France estimates a nuclear disaster could cost them up to $580 Billion. http://www.reuters.com/article/2013/02/07/us-france-nuclear-disaster-cost-idUSBRE91603X20130207.

collaborate and coordinate with potentially affected state agencies[169] to monitor the federal waste management program and represent California's interests regarding potential impacts in any licensing proceeding for a permanent high-level nuclear waste repository to protect California's interests regarding potential impacts to the state.

- The Energy Commission, as coordinator of the California Nuclear Transport Working Group[170], should continue to collaborate and coordinate with potentially affected state agencies[171] to participate in U.S. DOE and western regional planning activities[172] to ensure safe and event-free nuclear waste transportation.
- The Energy Commission, as coordinator of the California Nuclear Transport Working Group, should continue to collaborate and coordinate with potentially affected state agencies to participate in U.S. DOE used fuel disposition campaigns and western regional planning activities for removal of stranded used fuel and greater-than-Class-C low-level radioactive waste from shutdown nuclear power plant at Rancho Seco, San Onofre, and Humboldt Bay.
- Since San Onofre went offline in 2012, energy utilities and the state have worked to provide Southern California with reliable electric power. With the retirement of San Onofre, continued efforts are needed to develop a long-term plan that ensures reliability for decades to come. The Governor requested leadership from the following state energy agencies to develop this long-term plan: the California ISO, Energy Commission, CPUC, South Coast Air Quality Management District, San Diego Air Quality Management District, State Water Resources Control Board, SCE, and SDG&E.

Section 4: Energy Sector Priorities

Following the loading order, the table below provides a list of priority recommendations to put California on a trajectory to meet the 2050 GHG reduction goal. Overall, a clear focus is needed on increasing energy efficiency in existing buildings, advancing storage to integrate renewable resources, advancing CCUS, and supporting RD&D to advance innovation.

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[169] California Attorney General's Office, Department of Conservation-California Geological Survey, Department of Water Resources, Department of Fish and Wildlife-Office of Spill Prevention and Response, Department of Public Health-Radiologic Health Branch, Department of Toxic Substances Control, California Department of Parks and Recreation- Natural Resources Division.

[170] Established in 1989 to advise California Interagency Nuclear Waste Task Force and coordinate California's preparation for federal nuclear waste shipments; the group initially focused on transuranic waste shipments, but was later expanded to include spent fuel and other large quantity radioactive material shipments.

[171] California Office of Emergency Services, California Environmental Protection Agency, California Highway Patrol, Department of Public Health-Radiologic Health Branch, California Department of Transportation, California Public Utilities Commission-Rail Safety and Operations Branch, Department of Fish and Wildlife-Office of Spill Prevention and Response.

[172] Western Governors' Association Waste Isolation Pilot Plant Transportation Advisory Group and Western Interstate Energy Board High-Level Nuclear Waste Committee.

Energy Efficiency	• Focus is needed on increasing the efficiency of the existing building stock. There should be expeditious implementation of the draft action plan for the AB 758 Program once finalized. • The Energy Commission should adopt triennial updates of mandatory and reach standards to achieve ZNE standards for newly constructed homes by 2020 and newly constructed commercial buildings by 2030. • The Energy Commission and CPUC should coordinate future IOU "new construction-related" programs with the Energy Commission's efforts to meet the ZNE goals through triennial updates of mandatory and reach standards. • Intervene in U.S. DOE proceedings to represent the interests of California regarding the upgrade of federal appliance efficiency standards. • The Energy Commission should continue to engage with the U.S. DOE proceedings to develop common test methods and appliance efficiency databases. • The Energy Commission should adopt appliance and reach standards that focus on reducing plug loads to enable California's ZNE goals to be achieved. • Continue to reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy, including the energy associated with the use of water. • The Energy Commission should adopt an enforcement process for violations of appliance efficiency regulations and impose civil penalties to increase compliance with the Appliance Standards. • The Energy Commission and CPUC should jointly pursue improved compliance with the Building Energy Efficiency and Appliance Standards. • The Energy Commission and the CPUC should collaborate on research to advance technologies and strategies, as well as identify the most cost-effective opportunities for new appliance standards and updates to appliance standards. • The Energy Commission and the CPUC should collaborate on research to advance ZNE building standards and the 758 Program once finalized; improve efficiency of existing technologies; develop and demonstrate advanced technologies, integrated products, and strategies; encourage adoption through utility incentive programs or building energy efficiency codes; and understand consumer behavior.
Demand Response	• Implement the action plan for advancing demand response that is part of the *2013 IEPR*.
Combined Heat and Power	• Efforts should be made to ensure that new and existing CHP is appropriately valued under future regulatory amendments to California's cap-and-trade program. • Evaluate potential opportunities to incentivize the development of new bottoming-cycle CHP within existing state programs and the development of new CHP in state and other public facilities. Pursue opportunities on public facilities include development at hospitals and waste water treatment plants throughout California, but particularly in Orange County and San Diego County due to the closure of the San Onofre. • The CPUC, in collaboration with the Energy Commission, should examine and clearly define the interconnection rules for CHP facilities interested in expanding their systems and dispatch capabilities within an existing contract. • Further RD&D is needed to advance ultraclean emission technologies, reduce costs, integrate emerging, clean CHP technologies in diversified applications, and demonstrate CHP applications using biomass and other feedstocks.

Renewable Energy	• California's electricity planning efforts need to improve and expand. Actions to maximize the benefits of renewable energy must include modifying procurement practices to develop a higher-value portfolio that includes not just lower-cost projects but also those that provide integration services, encourage investment in disadvantaged communities, create jobs in California, and provide value to the state as a whole. • California must address how to fund clean energy investments. • Cutting-edge RD&D is needed to produce the next generation of clean energy technologies. • As California works to achieve its renewable energy goals, its actions must send appropriate price signals to help shape investments and influence behavior. At the same time, rate design must be fair, sustainable, and include mitigation measures for those who are disadvantaged. Actions should also lower the cost of renewables and reduce impacts on electric rates. • California's energy system has disproportionately affected many of the state's disadvantaged communities, which may not be in line to receive many of the benefits of increasing renewable development throughout the state. Actions to promote renewable energy must also ensure that the costs and benefits of renewable development are fairly distributed. • To help move toward an electricity system that primarily uses non-GHG emitting generation sources, the state should evaluate policies for ensuring continuing post-2020 reductions in the carbon intensity of electricity generation. Studies conducted should consider impacts on GHG emissions, as well as maximizing the value of renewable energy generation through cost-benefit assessments that include costs associated with integration, permitting, interconnection, and impacts on retail electricity rates.
Geothermal	• The utilities and the CPUC should adopt changes to procurement practices for renewable energy generation such that procurement decisions consider an expanded suite of renewable energy benefits. • Using geothermal power's potential as a flexible resource should be encouraged and its ancillary benefits to the grid should be recognized in power pricing agreements. • Research is needed to further develop technologies and tools for remote sensing, surface, and downhole investigations and reservoir modeling to reduce the costs of geothermal exploration and development. • Funding should also be provided for increased exploration to identify undiscovered geothermal resources.
Distributed Renewable Energy	• The recommendations highlighted from the *2012 IEPR Update* in the Renewable Energy Generation section also apply to DG. • Build transparency into the distribution system planning to integrate increasing quantities of DG while maintaining reliability, controlling costs, and reducing emissions. • Resolve and implement interconnection reforms in a timely manner. • Determine what operational communication and control technologies are needed to provide greater visibility and respond to dispatch instructions from both the California ISO and utilities.
Integrating Renewable	• Develop a forward procurement mechanism designed so that all resources, demand response, energy storage, distributed technologies and natural gas

Resources	power plants can compete to provide integration services. • Expand participation of regional balancing authorities in the California ISO/PacificCorp EIM, which provides a low cost, low risk means of achieving operational efficiency and flexibility needed for greater penetration of intermittent renewable resources. • Implement storage procurement targets adopted by the CPUC in October 2013 to encourage the cost-effective deployment of energy storage. • Promote RD&D for renewable integration, particularly on storage.
Bioenergy	• Explore all mechanisms to fund biomass collection and distribution. • Develop aggressive biomass-use goals. • Develop standards for sustainable forest biomass use. • Develop a programmatic environmental impact report focused on streamlining the environmental review process for SB 1122-type projects. • Modify procurement practices to develop a higher-value biopower portfolio. • Increase the research and development for projects that inject biomethane into California's natural gas pipelines.
Solar Space and Water Heating	• Continue rebates for SWH, space heating, and solar cooling applications. • Increase targeted marketing and outreach to increase consumer awareness and adoption of SWH and solar space heating. • Increase efforts to develop better workforce training to help ensure proper installation, improve performance, and increase the number of qualified installers. Additional training and education is needed for architects, engineers, designers, building owners, facility managers, consultants, and installers. • Continue RD&D to help bring down costs, increase reliability, and advance technology innovation.
Natural Gas with Carbon Capture Utilization and Storage	• Policy actions are needed to promote CCUS projects. Policy and regulatory barriers and recommendations for solutions are discussed in detail in a 2010 report by the California Carbon Capture and Storage Review Panel. • Facilitate a public/private partnership to demonstrate capture and geologic storage of at least one hundred thousand tons per year of CO2 to verify regulatory frameworks and quantification methodologies. • Demonstrate and validate the grid support co-benefits of operating CO2 capture systems for natural gas power plants in a manner that maximizes the aggregate value of peak power production, spinning reserve capacity, and GHG emissions reduction. • Demonstrate CO2 capture technologies and utilization options that reduce costs, energy and water use, and provide economic benefits through new low-carbon products, such as plastics and building materials. • Demonstrate sustainable land management practices for forests, rangelands, wetlands, and agricultural lands that maximize the collective value of economic productivity, carbon storage, and wildfire control, while meeting goals for biodiversity and habitat preservation, soil conservation, and water quality.
Nuclear	• Monitor the federal waste management program and represent California in any licensing proceeding for a permanent high-level nuclear waste repository to protect California's interests regarding potential impacts to the state. • Participate in U.S. DOE and western regional planning activities to ensure safe

	and event-free nuclear waste transportation. • Participate in U.S. DOE used fuel disposition campaigns and western regional planning activities for removal of stranded used fuel and greater-than-Class-C low-level radioactive waste from shutdown nuclear power plant sites in Rancho Seco, San Onofre, and Humboldt Bay. • Since San Onofre went offline in 2012, energy utilities and the state have worked to provide Southern California with reliable electric power. With the retirement of San Onofre, continued efforts are needed to develop a long-term plan that ensures reliability for decades to come.

Section 5: Conclusions

In conclusion, California must do nothing less than transform its energy system to meet the 2050 GHG reduction goal. This will be a monumental undertaking, but one that is technically achievable. The policies laid out in this working paper break down the problem into its key components: reducing energy demand and decarbonizing energy supply. A diversified suite of policy options must be pursued in part because it is unclear what technological or other breakthroughs may happen in the coming decades, and because a multi-faceted approach makes each element more achievable. Reducing demand with energy efficiency, demand response, and CHP lessens the burden to reduce GHGs on the energy generation side. Although the future energy generation mix is unknown, this working paper lays out a vision for decarbonizing California's electricity generation mix using a portfolio of strategies which include: a decrease in the cap on carbon emissions, an increase of clean technologies, increased use of solar thermal to displace natural gas and electricity, and the use of some natural gas-fired electricity with CCUS along with storage and demand response to help maintain reliability of the grid. Whether nuclear continues to be part of the state's electricity mix is also unknown and depends in part on whether a permanent solution to nuclear waste is developed and if plants can be located in seismically safe areas. Despite the uncertainties, California must move forward to find innovative solutions to the difficult problem of meeting the state's energy needs while dramatically reducing GHG emissions. Increased research and development will be critical to success and areas of focus include energy efficiency, storage for renewable integration, and CCUS. Transforming the energy sector will require partnerships at the state, federal and local level and with industry, businesses, environmental groups, environmental justice groups, and Californians statewide.

Transportation Working Paper
(Vehicles/Equipment, Fuels, Land Use and Housing, and Infrastructure)

The transportation system—which includes vehicles/equipment, transportation fuels, infrastructure, housing and other land use location decisions—is the largest contributor to GHG emissions, with transportation sector tailpipe emissions accounting for about 38 percent of emissions, and is the primary source of smog forming and toxic air pollution in the State. The Global Warming Solutions Act (Assembly Bill (AB) 32, Nunez, Chapter 488, Statutes of 2006) requires California to reduce GHG emissions to 1990 levels by 2020, and to maintain and continue reductions beyond 2020. Governor Brown reaffirmed California's commitment to reduce GHG emissions 80 percent from 1990 levels by 2050 (Executive Order S-03-05) in Executive Order B-16-2012 by establishing a parallel transportation sector target.

This document aims to define the steps toward meeting the 2050 goal, focusing on concrete actions and the subsequent policy priorities for State agencies to take over the next five-year period and is organized into the following sections: Vision (a view to where we need to go), Progress to Date (today's policy portfolio); System Outlook (in three strategic areas); and Recommended Priorities (explicit policy actions for the next five years).

I. A Vision for the *Future Landscape*

Achieving the 2050 goal will require a fundamental, holistic transformation of the transportation system—in how communities develop and expand, how people travel, how freight is moved, and what fuels are used—requiring significant innovation and, of all the GHG emission sources, will most directly affect the daily lives of Californians.

- For California communities and passenger transportation, this means: development of sustainable communities with a range of mobility choices including easy and equitable access to public transit, active transportation (including walking and biking), and other alternative modes of transportation; improved public transit and rail service utilizing zero and near-zero emission technologies; transportation connectivity among vehicles and between vehicles and infrastructure; optimized operating performance of existing infrastructure; a shift in new investments from road expansion towards "fix it first"; and a vehicle fleet composed of mainly zero emission vehicles powered by clean electricity and hydrogen. The priority of sustainable communities means a focus on integrated, comprehensive outcomes (including public health, economic, environmental, and social equity) beyond consideration of just GHG emissions. ARB's Advanced Clean Cars Program and the Sustainable Communities and Climate Protection Act of 2008 (Senate Bill (SB) 375) chart the course for starting this transformation in vehicle technology and land use. Major investments, such as high-speed rail beginning in the Central Valley, serve not only as a new, zero-emission means of interregional travel where none currently exists, but also as a catalyst for the type

of land use and development where transit connectivity, walking, and bicycling thrive.

- For freight transportation, this means: moving goods more efficiently and with zero or near-zero emissions; providing acceptable velocity and expanded system capacity; and optimizing movement of freight between modes, while integrating with the national and international freight transportation system. This will include lower-carbon fuels during the transition to a zero emissions freight network. The transformation will have important benefits for keeping California's ports, railroads, airports, and logistics industry competitive; improving the delivery of California's products to other states and countries; creating jobs in California and training local workers to support the new freight transport system; and improving air quality and health in California's impacted communities.

- These changes in passenger and freight transportation will require a corresponding transformation of the energy supply sectors (fuels and electricity). In order to transition to sustainable energy for transportation, the most recent Global Energy Assessment states that "without question a radical transformation of the present energy system will be required."[1] Ultimately, achieving our goals will require widespread use of low-carbon electricity and hydrogen as transportation fuels for battery electric and fuel cell vehicles, and low-carbon, renewable fuels where internal combustion engines cannot feasibly be replaced.

Designing and implementing measures to support sustainable communities and a transition to a sustainable transportation sector will require significant public and private investment, sustained financial and non-financial incentives, and strong partnerships and coordination at the local, regional, State, and national levels.

Co-Benefits of Change

The need to reduce GHG emissions is only one of the factors driving this transition. Considerable emission reductions are also needed to achieve the health-based federal ozone standard by 2032. ARB's 2012 *Vision for Clean Air: A Framework for Air Quality and Climate Planning*[2] study showed that meeting the air quality standards and climate change goals require similar and complementary strategies focusing on many of the same emission sources particularly within the transportation sector. The air quality standard attainment deadline for ozone will be a principle driver for the timing of these emission reductions.

[1] GEA, 2012: *Global Energy Assessment - Toward a Sustainable Future*, Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria.
[2] ARB's 2012 *Vision for Clean Air: A Framework for Air Quality and Climate Planning* can be found at http://www.arb.ca.gov/planning/vision/vision.htm .

Connections Between Vehicles, Fuels, Housing and Land Use, and Infrastructure

There is a strong link between land use, housing location decisions, and strategies to reduce emissions from the transportation sector. This document aims to chart a holistic approach to reducing transportation related GHG emissions, including:

- Community-based strategies that reduce dependency on single-occupancy vehicle travel thereby reducing vehicle miles travelled (VMT) and correspondingly reducing emissions. For the purposes of this document, "community-based strategies" focus on those that reduce transportation related emissions.

- Technology-based vehicle and fuels strategies—cleaner and more efficient engines, vehicles (include exploring potential benefits of new mobility innovations of connected and autonomous cars), and equipment and lower-carbon fuels.

- Transportation system construction and operational efficiency improvements, such as highway ramp metering, transit system signal prioritization, and greener pavement technologies.

Sustainable communities are designed to provide housing for all income groups and when combined with cleaner, more sustainable passenger and freight transportation can provide additional benefits such as:

- increased mobility and transportation choices;
- reduced congestion; greater housing choices;
- housing at all price points with access to public transit;
- improved public health as a result of better air and water quality and the use of active transportation;
- natural resource conservation, including preservation of agricultural lands and sensitive habitats;
- economic benefits such as opportunities for neighborhood economic development and lower costs for community infrastructure;
- energy security; and
- greater equity through improved access to jobs, housing, and everyday needs.

The strategies associated with achieving sustainable communities have the added benefit of providing an opportunity to address the health inequities that exist in California communities. These strategies not only improve the health of everyone, but they narrow the existing gaps in health inequalities and increase the ability of vulnerable communities to adapt to climate change. In addition, low-carbon freight strategies are particularly beneficial to vulnerable communities located near ports, rail yards, freeways, and distribution centers by lowering the localized health risk associated with diesel soot but also cutting black carbon that acts as a powerful, short-lived climate forcing pollutant.

Housing Role

Within urbanized areas, residential development accounts for the largest share of land area, constituting a major influence on regional development footprints and travel patterns. As such, integrating transportation and residential land use is one of the most impactful strategies for reducing GHG emissions, as well as other forms of air pollution, for the transportation system. Housing development is the largest, single subsector of the construction industry. Pre-1980 construction is responsible for nearly three quarters of all GHG emissions generated by the building industry. Building new housing and preserving the existing housing stock affords the greatest potential for maximizing the benefits of green technology.

Housing also plays a pivotal role in supporting economic vitality, energy efficiency, public health and safety, and insuring access to education and job opportunities. Governmental actions supporting the location, variety and availability of housing at all price points are critical to implementing GHG emissions reduction policies, along with addressing other public policy objectives. Infill development patterns, including transit oriented development (TOD), which focus on the proximity and connectivity of higher density mixed use and residential development to employment and service centers and amenities can increase the effectiveness of these relationships This development pattern is also referred to as "Equitable TOD."

Denser, compact forms of development can reduce travel time, trips, and travel costs. Studies indicate public transit ridership drops off dramatically beyond four miles from transit stations, particularly for those commuting to and from places of employment, because ridership generally depends on variables including quality, frequency of stops and travel time. For example, over half (57 percent) of 1,200 workers in a 2007 Harris poll indicated that they would consider moving closer to work if they could find affordable housing near their workplace. Another survey of 300 companies reported that one in three find that the lack of affordable housing nearby impacts the ability to attract or retain qualified entry- and mid-level workers.[3] Employers and regional economies are at a competitive disadvantage without a sufficient supply of affordable housing.

Collaborative Approach

Climate change touches every part of society and as a result requires an unprecedented level of collaboration, which is especially true for the transportation system. The State of California is actively working with federal and international partners to collectively reduce GHG emissions, regional organizations such as council of governments or metropolitan planning organizations to assist with implementation of SB 375, non-governmental organizations and universities to support regional collaboratives, and groups such as the Alliance of Regional Collaboratives for Climate

[3] Urban Land Institute. 2007, June 4. "Lack of Affordable Housing Near Jobs: A Problem for Employers and Employees." Press Release. Retrieved August 13, 2010 http://www.housingcolorado.org/images/uploads/47ab69762a6aa

Adaptation, through whom resources and information are shared. The trend towards regionalization in the discussions of climate change is a needed but complicated process. This is also true at the transportation corridor level for all modes and jurisdictions. Many individual jurisdictions understand the value of coordinating at a regional and corridor level and are participating in joint procurement, grant applications, technology strategies, and policy implementation. These efforts collectively are helping the State to achieve statewide GHG reduction goals and are being supported through collaboration with State agencies and departments through funding, technical support, and assistance with convening and coordination. The State recognizes the need to support and build on these efforts to ensure long term GHG emission reduction targets are met while also achieving the State's planning priorities. Furthermore, outreach and collaboration with businesses will be a necessary component of strategies moving forward to understand the challenges with respect to logistics, fleet operations, location, and economic development.

Energy Sector Coordination

Ongoing coordination between all GHG emission sectors will be necessary to reflect the interconnections between the sectors and possible changes in statewide priorities. However, there is a direct relationship between the evolution of the transportation sector and future energy needs. The vision described herein includes significant electrification of the transportation fleet and growing reliance on hydrogen that will impact the energy sector. For example, as electricity, specifically renewably-generated electricity, fuels more of the transportation sector, there is opportunity for fleets to manage energy consumption or store excess energy to provide benefits to the grid through vehicle-grid integration. Accordingly, transportation and energy planning efforts need to be closely coordinated to ensure both sectors evolve compatibly.

II. Progress to Date – Today's Portfolio of Policies and Programs

There are numerous efforts taking place at the local/regional, State, federal, and international level to achieve GHG emission reductions focused on the transportation sector and the development of sustainable communities. While not exhaustive, this section describes the key laws, executive orders, policies, programs and regulations - especially at the State level - that are driving these efforts.

State Laws and Executive Orders

- AB 1493: Vehicular greenhouse gas emissions – AB 1493 (Pavley, Chapter 200, Statutes of 2002) required ARB to adopt regulations that achieve the maximum feasible and cost effective reduction in GHG emissions from new motor vehicles. ARB approved regulations in 2004, which were amended in 2009 and again in 2012, wherein the control of smog-causing pollutants and GHG emissions were combined into a single coordinated package of standards (commonly known as Advanced Clean Cars).

- SBX1 2: California Renewable Energy Resources Act – Established in 2002 under SB 1078, accelerated in 2006 under SB 107 and expanded in 2011 under SBX1 2 (Simitian, Chapter 1, Statutes of 2011), California's Renewables Portfolio Standard (RPS) applies to all electricity retailers in the State (including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators) and requires these entities to adopt RPS goals of 20 percent of retails sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020.

- Executive Order S-03-05 – Established the following GHG emission reduction targets: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels. The Executive Order also creates the Climate Action Team and directs the Secretary of Cal/EPA to coordinate efforts with meeting the targets with the heads of other State agencies.

- Executive Order S-01-07 – Established the statewide goal to reduce the carbon intensity of California's transportation fuels by at least ten percent by 2020. This Executive Order also gave ARB the authority to determine if the Low Carbon Fuel Standard could be considered a discreet early action.

- SB 375: Sustainable Communities and Climate Protection Act of 2008 – SB 375 (Steinberg, Chapter 728, Statutes of 2008) reduces GHG emissions from passenger vehicles through an integrated approach to regional transportation and land-use planning.

  SB 226: Environmental quality – SB 226 (Simitian, Chapter 369, Statutes of 2011) required an infill streamlining update to the CEQA Guidelines which set forth a streamlined review process for infill projects. The update also contains the performance standards that will be used to determine an infill project's eligibility for that streamlined review[4].

- Executive Order B-16-12 – Established long-term targets of reaching 1.5 million zero emission vehicles on California's roadways by 2025 and reducing transportation-related GHG emissions by 80 percent below 1990 levels by 2050 (Executive Order S-03-05 is an economy-wide target). The Executive Order also set zero emission vehicles purchasing requirements for State government fleets. In February 2013, an interagency working group developed the *ZEV Action Plan*[5] which identifies specific strategies and actions that State agencies will take to meet milestones of the executive order.

- Executive Order B-18-12 – Requires State agencies identify and pursue opportunities to provide electric vehicle charging stations, and accommodate

[4] http://opr.ca.gov/s_sb226.php
[5] The light-duty focused ZEV Action Plan can be found at http://opr.ca.gov/docs/Governor%27s_Office_ZEV_Action_Plan_%2802-13%29.pdf .

future charging infrastructure demand, at employee parking facilities in new and existing buildings.

Implementation of these key laws and Executive Orders is ongoing through activities at the local, regional, and State level. These efforts are occurring through a combination of approaches—regulatory, voluntary actions, incentives, and research/development/deployment—allowing for flexibility and a customized approach to maximize emission reductions.

Local and Regional Efforts

- SB 375 Sustainable Communities Strategies (SCS) – SB 375 requires the 18 federally-designated Metropolitan Planning Organizations (MPO) in the State to adopt and submit to ARB for evaluation a SCS that uses land-use and transportation strategies to reduce the region's passenger vehicle GHG emissions. To date, ARB's Executive Officer has accepted five SCSs from the following agencies: the San Diego Association of Governments, the Southern California Association of Governments, the Sacramento Area Council of Governments, the Butte County Association of Governments and the Tahoe Metropolitan Planning Organization/Tahoe Regional Planning Agency. Each of the submitted SCSs either met or exceeded their ARB-established per capita passenger vehicle GHG emission reduction target. The remaining MPOs are now in the process of developing and adopting their first round of SCSs as part of their next Regional Transportation Plan updates and will all be completed by the close of 2015. Local governments and other stakeholders play a large role in helping to develop the transportation and land-use scenarios used in the SCS development process. In addition, local governments are crucial partners for the implementation of the SCSs because land use authority remains squarely within the purview of the local governments. Builders and a host of cross-sector organizations implement the SCSs.

- General Plans and Local Climate Action Plans – Local governments have an important role to play in reducing GHG emissions to achieve the State's 2050 target. The Governor's Office of Planning and Research maintains detailed recommendations for establishing targets, developing a Climate Action Plan or Greenhouse Gas Reduction Plan in the *Climate Action Plan Technical Advisory* (under development) and in the *General Plan Guidelines* (draft release in early 2014)[6]. Local governments also maintain comprehensive general plans that guide growth and development throughout their jurisdiction, and may choose to incorporate additional GHG emission reduction strategies or a climate action plan as part of a general plan (or another community plan) or as a separate document. Cities and counties are required to update the housing elements of their general plans to implement their share of their Regional Housing Need Allocation, which, in areas with MPOs, must be consistent with the SCS of the

[6] These documents and related supporting documentation and can be found on OPR's website at www.opr.ca.gov .

regional transportation plans. In addition, other entities, such as universities and special districts, also may prepare long-term development plans that address climate change. There are benefits to aligning the GHG emission reduction strategies in these various plans to take advantage of a wider range of mitigation strategies, streamlining environmental review, and establishing a consistent set of baseline conditions and growth assumptions. These local planning products often result in complete streets policies, bicycle and pedestrian master plans, Safe Routes to School programs, and much more.

Many of these local and regional efforts will not only benefit climate and air quality outcomes, but will also positively impact resource conservation, quality of life, public health measures, economic indicators, and social equity. The frameworks established in adopted SCSs call for strategies that will deliver these co-benefits, thus full implementation of the first round of SCSs and other local plans should bring about a suite of improvements to California regions.

State Efforts

The **California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA)** has taken the following actions to reduce GHG emissions from transportation sources and support sustainable communities:

- Sales and Use Tax Exclusion Program – The Sales and Use Tax Exclusion (STE) Program provides a sales and use tax exclusion for advanced manufacturers and manufacturers of alternative source and advanced transportation products, components or systems. The STE Program was originally authorized by Senate Bill 71 (Padilla, Chapter 10, Statutes of 2010), which allowed CAEATFA to provide a sales tax exclusion for manufactures of alternative source and advanced transportation products. The STE Program was recently expanded by Senate Bill 1128 (Padilla, Chapter 667, Statutes of 2012) to include advanced manufacturing projects.

ARB has taken the following actions to reduce GHG emissions from transportation sources and support sustainable communities:

- Low Carbon Fuel Standard – The Low Carbon Fuel Standard requires a minimum of 10 percent reduction in carbon intensity of transportation fuels by 2020. This accounts for about 19 percent of the goal set forth by AB 32. An additional benefit of this regulation is that it will diversify the fuel pool, which in turn leads to less susceptibility to gasoline and diesel price spikes due to the cost of oil.

- Advanced Clean Cars – The Advanced Clean Cars Program includes more stringent GHG emission standards, tighter criteria pollutant standards, and increased zero emission vehicle (ZEV) production requirements from 2017-2025 in passenger cars and trucks, including both battery electric and fuel cell

vehicles. These regulations will result in light-duty vehicles sold in 2025 emitting 75 percent less smog-forming pollution and 34 percent less GHG emissions.

- Cap-and-Trade Regulation – The Cap-and-Trade Regulation is a market-based regulatory program that reduces GHG emissions through a declining cap on 85 percent of California's GHG emissions. Beginning on January 1, 2015, GHG emissions from transportation fuels will be included in the cap.

- SB 375 Sustainable Communities Strategies – SB 375 requires ARB to set regional GHG emissions reduction targets. These targets were set in 2010. ARB also evaluates the SCSs to ensure, if implemented, they would achieve the GHG emission reduction targets.

- Ships-at-Berth (Shore Power) – The Ships-at-Berth Regulation reduces emissions from diesel auxiliary engines on ships while berthing at California ports by requiring them to plug into grid-based shore power while at berth and turn off the on-board auxiliary engines, or use equally effective alternatives. In addition, four ports (Los Angeles, Long Beach, Oakland, and Hueneme) have received contracts to provide about $80 million in State grants for early or extra emission reductions at 25 berths upon project completion.

- Heavy-Duty Truck GHG Regulations – The Heavy-Duty (Tractor-Trailer) Greenhouse Gas Regulation, adopted by ARB in 2008, reduces GHG emissions by improving the fuel efficiency of heavy-duty tractors through improvements in tractor and trailer aerodynamics and the use of low-rolling-resistance tires. In 2013, ARB adopted a regulation establishing GHG emission reduction requirements for all medium- and heavy-duty vehicles and engines manufactured for use in California, harmonizing with the GHG emission reduction rule finalized by U.S. EPA and the National Highway Traffic Safety Administration (NHTSA) in 2011. For Class 8 heavy-duty vehicles, this "Phase I" GHG standard will reduce new vehicle emissions by four to five percent per year from 2014-2018.

- Diesel Vehicle and Equipment Fleet Rules – ARB has adopted a number of fleet rules in recent years to reduce emissions from diesel trucks, buses, and off-road equipment. These regulations were adopted primarily to reduce diesel particulate matter and NOx emissions; however, they provide ancillary climate change benefits by reducing black carbon emissions.

- Tire Pressure Regulation – The Tire Pressure Regulation reduces GHG emissions from vehicles operating with under inflated tires by requiring automotive service providers to inflate them to the recommended tire pressure.

- Automotive Refrigerant Regulation – This regulation reduces GHG emissions associated with the use of small containers of automotive refrigerant.

- Advanced Technology Incentive Funding – ARB provides funding for advanced technologies that reduce criteria pollutant and air toxic emissions, often with concurrent climate change benefits. To date about $283 million has been dedicated to these technologies which include: rebates for light-duty plug-in electric and fuel cell vehicles, vouchers for hybrid and zero emission heavy-duty trucks, grants for installation of shore-based electrical power for ships, and technology demonstrations such as hybrid tugboat retrofits. In 2013, the State extended fees for the Air Quality Improvement Program until 2024 which is expected to provide about $25 million annually for advanced technologies.

The **California Department of Transportation (Caltrans)** has taken the following actions to reduce GHG emissions from transportation sources and support sustainable communities:

- Published report in April 2013 titled: "*Caltrans Activities to Address Climate Change*" which quantifies recent activities undertaken to reduce GHG emissions resulting from our statewide operation. It identified that in 2011, these activities resulted in a reduction of approximately 161,500 tons of GHGs, which is the equivalent of removing approximately 31,000 vehicles off the road for one year.

- Concrete Specifications – Caltrans has adopted concrete specifications to allow contractors to use greater amounts of less-GHG-intensive alternatives to Portland cement when building roads and bridges. Use of these alternatives is reducing the GHG emissions associated with road projects.

- Alternative Asphalt Pavements – Caltrans supports the use of alternative asphalt pavements that contain recycled rubber, recycled pavements, or binding agents, allowing pavement to be mixed and laid at lower temperatures, which reduces GHG emissions associated with manufacturing materials and construction fuel use.

- Mass Transportation – Caltrans supports three of the top five Amtrak passenger lines in the country and has taken measures to encourage multi-modal bicycle and train trips. Caltrans financially supports California's local transit operators, which operate over 20,000 buses, rail cars, and other mass transportation vehicles.

- Promoting Biking and Walking – Using State and federal funds, Caltrans supports active transportation with over $1 billion spent on facility projects since 1992. The recently created Active Transportation Program (Senate Bill 99, 2013) increases funding of bicycle and pedestrian infrastructure.

- Blueprint Planning Grants – Prior to adoption of SB 375, Caltrans provided $20 million in grants to help regional transportation agencies create long-term integrated transportation and land use plans.

- Complete Streets Implementation Action Plan – The Complete Streets Implementation Action Plan spurred a series of comprehensive edits to the Highway Design Manual that have the potential to reduce GHG emissions by creating streets conducive to all modes of travel.

- Environment Justice Support – Caltrans administers the Community-Based Transportation Planning and Environmental Justice grant programs that include the goal of integrating land-use and transportation planning through the public engagement process.

- Alternative Fueled Vehicles – Caltrans operates approximately 3,000 alternative fuel vehicles as well as other advanced technology vehicles and equipment that reduce fuel consumption.

- High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) – New HOV lanes allow cars with at least two (or in some cases, three) occupants to bypass congestion, as well as HOT lanes that are open to carpools or to single-occupant vehicles that pay a fee. These lanes have the potential to reduce GHG emissions by encouraging drivers to carpool.

- Recycled Materials – Caltrans uses recycled materials such as tires to reduce hill side erosion, and the use of agricultural green waste as mulch for roadway landscaping.

The **California High Speed Rail Authority (Authority)** has taken the following actions to reduce GHG emissions from transportation sources and support sustainable communities:

- Initial High-Speed Rail Segment – Construction of the high-speed rail system is underway with the award of the first construction contract in August 2013. As soon as the initial operating segment opens it will reduce GHG emissions through shifting trips from air and driving.

- Clean Construction – The Authority is committed to net-zero emissions during construction through new, clean construction vehicles, materials recycling, and an urban forestry emissions offset programs in the Central Valley that will provide direct GHG reduction and compound air quality and energy savings benefits. All major contracts include the green construction requirements, and the RFP for urban forestry is scheduled for release in Spring 2014.

- Renewable Energy – The Authority has committed to using 100 percent renewable energy for the high-speed rail system and in April 2013 released a formal *Call to Industry: Sourcing Renewable Power Supplies* to solicit guidance and insight about purchasing renewable power sources.

- Transit Oriented Development – The Authority has engaged seven cities that are anticipated to have high-speed rail stations. This planning funding partnership, administered by the Authority, provides local jurisdictions planning funds to develop market analyses, zoning revisions, general plan updates, or other planning activities to develop TODs that support local sustainable community goals and high-speed rail ridership. This program includes up to $9,000,000 from federal, State, and local sources.

- Rail Modernization – As part of the investments to support the high-speed rail system, regional commuter and urban rail systems are being upgraded and expanded to provide connectivity to the future high-speed rail system, as well as shared-use investments that high-speed rail will ultimately access, such as the electrification of the Caltrain corridor between San Francisco and San Jose. The direct GHG reductions of Caltrain electrification will be realized in 2019, while the investment in other systems will see GHG reductions from increased ridership and mode shift.

- Agricultural Conservation – As part of mitigation for the high-speed rail system, the Authority, through an agreement with the department of Conservation, is seeking permanent agricultural easements from willing sellers. Ideally, these easements support local jurisdictions land use priorities to protect at-risk land from development, reinforcing compact land use.

The **Department of Motor Vehicles (DMV)** has taken the following actions to reduce GHG emissions from transportation sources:

- Alternative Service Delivery Channels – The DMV continues to expand alternative service delivery channels to reduce the need for customers to have to visit a field office. On-line transactions offer the ability to make appointments, obtain handbooks, access training videos and take sample tests.

- ”Clean Air” Vehicles – The DMV administers a program to promote the purchase and use of plug-in and other low emission vehicles. A vehicle that meets specified emissions standards (plug in hybrids, compressed natural gas, battery electric and fuel cell electric vehicles) may be issued Clean Air Vehicle decals that allow the vehicle to be operated by a single occupant in the HOV (carpool or diamond) lanes of California’s freeways. Green clean air vehicle stickers have been available since January 1, 2012 to the first 40,000 applicants that purchase or lease vehicles meeting California’s enhanced advanced technology partial zero emission vehicle requirements (plug in hybrids). The law also extended the sunset date for the white stickers issued to battery electric, fuel cell electric and compressed natural gas vehicles until January 1, 2019.

The **California Highway Patrol (CHP)** has taken the following actions to reduce GHG emissions from transportation sources:

- Active Transportation Grants – As biking and walking become more available commute options, CHP is engaged in active bike and pedestrian safety grants. These focus on those areas where bike and pedestrian collisions are most frequent.
- Active Transportation Roadway Signage – Through its membership on the California Traffic Control Devices Committee, CHP is working with cities that are experimenting with various roadway markings, configurations and signage to promote and enhance the safety of cleaner modes of transportation.
- Polluters Enforcement – CHP works in partnership with ARB and Bureau of Automotive Repair regarding: enforcement of gross polluters and/or racing vehicles; modified exhaust, catalytic converters removed, engine modifications, etc., resulting in reduced polluters; assists ARB inspectors at roadside smog inspections throughout the state; commercial enforcement personnel routinely inspect and enforce California Vehicle Code statutes related to exhaust system requirements/maintenance on commercial motor vehicles. CHP's commercial vehicle enforcement program is incorporating proper tire inflation into the commercial vehicle inspection protocol.

- Electric School Buses – Along with ARB, Energy Comission, and industry, CHP works to increase the use of electric school buses.

The **California Energy Commission (Energy Commission)** has taken the following actions to reduce GHG emissions from transportation sources:

- Advanced Technology Incentive Funding – The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) invests $100 million annually to develop and deploy advanced technology fuels, hydrogen and other fueling infrastructure, vehicles (including zero emission buses), and workforce skills necessary to operate and maintain these new technologies. Over $400 million has been invested to date for more than 250 projects through ARFVTP, with about 30 percent of the funding going to advanced technology truck projects. This Energy Commission program has also been extended until 2024, at which time over $1.5 billion will have been invested in advanced technologies, low-carbon fuels, fueling infrastructure and vehicle projects.

- Vehicles and Fuels Research – Research and development efforts for GHG emission reductions have focused on improving the performance, efficiency and economics of natural gas and electric vehicles. These efforts include support to develop optimized natural gas engines with little or no performance or efficiency penalties. Planning is underway to demonstrate used medium-duty electric vehicle repower projects, hybridization designs that use battery power to minimize emissions, idling, and low-load engine operation. Research will also demonstrate the viability of in-state manufacturing and performance of on-board

advanced natural gas fuel tanks, as well as production of renewable natural gas from waste feedstocks.

- Battery Technology Research – Vehicle-grid integration research and demonstrations evaluate technical and economic feasibility for both consumers and utilities. It includes advanced bench-scale recycling processes with potential for commercial scale-up. Battery standardization research will capture lessons learned from previous efforts, life-cycle costs, and pathways to implement. The Energy Commission has proposed further research under the Electric Program Investment Charge (EPIC) on vehicle-grid integration, smart or managed charging, and battery second use.

The **Strategic Growth Council (SGC)** has taken the following actions to reduce GHG emissions from transportation sources and support sustainable communities:

- Sustainable Communities Planning Grant and Incentives Program – The SGC manages this local assistance grant program to fund cities, counties, and regions that conduct sustainable community planning, including transit-oriented development, with the requirement that the funded activities will lead to reduced GHG emissions. More than $50 million of grants have been awarded to date, with approximately $16 million allocated in the recent Round 3 solicitation. The Governor's Proposed Fiscal Year 2014-15 Budget allocates up to $100 million to support SB 375 implementation.

- Modeling Incentive Awards – In 2009, the SGC awarded more than $10 million to fund data gathering and model development projects necessary for regional agencies to comply with SB 375 (2008). The majority of these awards went to the State's 18 Metropolitan Planning Organizations, every one of which received funding from this program to improve the modeling available for their SCSs.

- UrbanFootprint – The SGC funded the UrbanFootprint land use scenario planning tool, which is available to State agencies, regional agencies, and local governments to identify the sustainability impacts of user-provided land use scenarios.

- Barriers to Infill Development – In 2013, the SGC adopted an infill action plan to mitigate the barriers to sustainable infill development. These actions will facilitate transit-oriented development and other low-VMT development strategies.

- Health in All Policies Task Force – The interagency Health in All Policies Task Force (facilitated by the Department of Public Health and operating under the auspices of the SGC) has conducted internal and external outreach to support local entities in the implementation of complete streets and active transportation.

- Local Government Outreach – The SGC pursues a many-faceted outreach and education program to support its grantees and other local governments by

connecting them to state resources and to one another. These efforts ultimately result in increased local capacity and increased adoption of sustainability practices among these local entities.

- Sustainability in State Infrastructure Spending – In 2013, the SGC initiated a project to integrate the State's Planning Priorities and the Environmental Goals and Policy Report into State agencies' infrastructure investment decision-making processes. The Council is developing a guidance document that assists with the incorporation of these priorities into future State infrastructure investment decisions within normal activities and coordination efforts.

The **California Public Utilities Commission (CPUC)** has taken the following actions to reduce GHG emissions from transportation sources:

- Alternative Fuel Vehicles Policy – CPUC is developing utility policy on alternative fuel vehicles to make sure the electric utilities that the CPUC regulates are prepared for the projected statewide market growth of plug-in electric vehicles (Rulemaking 09-08-009).

- Electric Vehicle Charging Infrastructure – In 2012, as a result of a settlement to resolve energy crisis litigation, NRG agreed with the CPUC to invest more than $100 million in charging infrastructure including 200 DC fast chargers and 10,000 "make ready" plug-in units at 1,000 locations.

- Energy Rates for Vehicle Charging – In 2012, the CPUC approved a temporary discounted energy rate for government agencies in Southern California Edison's territory to demonstrate and develop the market for zero emission electric bus technologies.

- Electric Vehicle Pilots – The CPUC approved several pilot projects each underway in three investor-owned electric utility service territories. The objectives of these pilots include understanding consumer charging behaviors, evaluating the impacts of time of use energy rates and metering technology, and testing the use of electric vehicles as demand response and limited energy storage resources.

- Battery Second Life Grid Applications – In 2013, CPUC approved a PG&E pilot to test how it can procure grid value from vehicle batteries both during and after their useful life in the vehicle. This pilot will help develop contracting methods that can be scaled up to commercial scale in the future, helping to improve the value proposition for PEV owners and PEV fleet operators.

- Support for Electric Vehicle Customers – In Rulemaking 11-03-012 (2011-present), CPUC is developing the utility mechanism for returning revenue from the sale of Low Carbon Fuel Standard credits to benefit electric vehicle customers.

The **California Department of Housing and Community Development (HCD)** has taken the following actions supporting reduction of GHG emissions from transportation sources and sustainable communities:

- Synchronized Regional Housing and Transportation Planning – Pursuant to SB 375, HCD has coordinated the Regional Housing Need Allocation process and housing element review with development of regional transportation plans and their SCSs.

- Housing Element Review and Certification – HCD reviews and certifies the housing elements of the general plans of local governments, which include identification of infill and TOD sites with appropriate zoning, development standards, and programs supporting development of RHNAs implementing their respective RTP/SCS.

- Funding of Infill and Transit Oriented Development Projects – HCD awards competitive low interest loans and grants to finance infill infrastructure grants, affordable housing, and TOD. These include higher density mixed use and mixed income housing developments and infrastructure supporting transit use, e.g. bike and pedestrian improvements.

- Housing Related Park Funding – HCD awards incentive grants for the creation or improvement of local parks to local governments which have constructed and/or preserved affordable housing. Bonus points are awarded for applications serving disadvantaged communities, those in park-deficient areas and when consistent with a regional blueprint plan.

- Technical Assistance and Regulatory Relief – HCD assists local governments and stakeholders in using provisions of State housing and land use law and best practices to implement housing and land use policies and programs supporting sustainable development patterns and practices. HCD works with other agencies to identify and resolve regulatory barriers to higher density and affordable housing development, including for example, housing sited proximate to high volume roadways.

- Electric Vehicle Charging Building Code Changes – HCD is developing recommendations for inclusion of plug-in stations for electric vehicle charging in the residential building code.

Federal Efforts

- Vehicle Emission Standards – The U.S. Environmental Protection Agency (U.S. EPA) and the National Highway Traffic Safety Administration (NHTSA) are taking coordinated steps—through setting GHG emission standards and improved fuel economy—to enable the production of a new generation of clean

vehicles. The agencies have finalized standards to extend the light-duty vehicle GHG National Program for model years 2017-2025 and have adopted GHG regulations for heavy-duty engines and vehicles. These efforts are coordinated and aligned with California standards.

- Tax Credits for Advanced Technology Vehicles – The federal government provides tax credits of varying amounts for the purchase of qualifying plug-in and fuel cell light-duty vehicles and the installation of alternative fuel infrastructure.

- Federal Renewable Fuel Standard (RFS) – The RFS program was expanded by the Energy Independence and Security Act (EISA) of 2007 to include diesel in addition to gasoline, and increased the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022.

- Partnership for Sustainable Communities – The U.S. Department of Housing and Urban Development (HUD), U.S. Department of Transportation (U.S. DOT), and U.S. EPA have joined together to help communities nationwide improve access to affordable housing, increase transportation options, and lower transportation costs, while protecting the environment through coordinated federal housing, transportation, water, and other infrastructure investments. Several of the first rounds of HUD Sustainable Communities grants were awarded to regions in California.

- Transportation Funding – U.S. DOT issues grants, in accordance with federal transportation authorization (current legislation: MAP-21, the Moving Ahead for Progress in the 21st Century Act), to eligible recipients for planning, vehicle purchases, facility construction, operations, and other purposes. These include funding for surface transportation improvements and planning, fixed guideway systems, rail, and bike/pedestrian projects.

- Air Quality and Energy Efficiency Transportation Incentive Funding – U.S. EPA has provided funding for SmartWay financing and periodically issues smart growth grants to support activities that improve the quality of development. The U.S. Department of Energy has several funding programs and initiatives to support energy efficiency, reducing petroleum consumption through transportation projects, and advanced vehicle technologies including, but not limited to: Energy Efficiency and Conservation Block Grant (EECBG) Program, Clean Cities initiative, and research and development funding through the Vehicle Technologies Office.

- Vehicle to Grid Projects – Pursuant to Executive Order 13423 (Strengthening Federal Environmental, Energy, and Transportation Management), the U.S. Department of Defense is converting its non-tactical fleets at Los Angeles Air Force Base and China Lake Naval Air Warfare Station to provide vehicle-grid

integration demand response and battery storage to the California Independent System Operator's wholesale energy and ancillary services markets.

III. System Outlook – Coordinated Policy and Planning

This section provides an overview of the necessary transition for the transportation sector in the 2035 and 2050 time-frames to meet California's climate change and air quality goals, and the initial steps over the next five years for how to get there. The section is organized into three strategy areas: (1) sustainable community and passenger transportation strategies; (2) freight transportation strategies; and (3) low carbon fuels and energy for transportation. However, we acknowledge significant crossover between these categories, and strategies for one category may affect the others. For example, future fuel and energy needs are directly related to the evolution of passenger and freight transportation. In each of these strategy areas, coordinated policy and planning will be required to strategically leverage public funding, align State-level regulations towards common strategies, and conduct local planning for inter-regional corridor and community development.

Achieving the long-term emission goals will require a new approach in policy development and implementation. A new coordinated policy and planning approach should utilize all available means, including, but not limited to, regulations, regional planning, enforceable agreements, project mitigation, and a sustained commitment to incentives (e.g., grants, vouchers, rebates, parking or transit benefits, high occupancy vehicle lane access, etc.). Each of these can play a strategic role in implementation of the vision for transportation. For example, alignment of statewide energy and emissions regulations and coordinated regional planning will be important to strategically encourage common strategies and maximize environmental benefits. Where commercialization barriers exist for new technologies, strategic use of public funding should catalyze new solutions or consumer acceptance. Existing consumer rebates for light-duty plug-in electric and fuel cell vehicles are expected to play a significant role in the full-scale commercialization of these technologies for years to come.

Fundamental to successful coordinated planning efforts is the framing of a consistent vision for California's transportation system that is reflected across the plans produced within and across different agencies. For example, over the next several years, ARB is undertaking significant efforts that all address transportation in some way: (1) the First Update to the Climate Change Scoping Plan; (2) the 2014 Sustainable Freight Strategy; (3) SB 375 target review; (4) the next major set of Ozone State Implementation Plans in 2016, and (5) the next phase of standard setting for vehicle and engine smog, toxics, and GHG emissions. During the same time period, Caltrans will produce the 2014 California Freight Mobility Plan and the 2040 California Transportation Plan in 2015. High Speed Rail is investing in local transit systems and will break ground in the central valley, providing an alternative to air and auto travel. In addition, the Energy Commission prepares a biennial integrated energy policy report that provides an overview of major energy issues and trends facing California and makes energy policy recommendations based on energy assessments and forecasts. Coordination across

State agencies is essential, just as it is equally imperative for the statewide efforts to incorporate the planning and implementation activities of the regional and local agencies. Tools developed to support these planning efforts should emphasize the needs of vulnerable communities including, but not limited to, access to affordable public transit, electric vehicle charging or other low-carbon fueling infrastructure; accessible low-cost housing; protections against housing displacement, and localized public health benefits.

Many of the strategies discussed in this section will require a long lead time to realize the benefits. Various strategies rely on infrastructure improvements that can take years to execute from planning to construction or advanced technologies to be developed and commercially available. Because of these practical hurdles, as well as the inevitable fleet and land-use transformation time delays, it is critical to start the planning and implementation of these strategies in the very near future in order to meet the 2032 and 2050 air quality and GHG emission reduction goals. This will require strong collaboration and partnerships, especially at the regional level, to ensure successful roll-out of the described strategies.

1) Sustainable Communities and Passenger Transportation – *Beyond SB375 and Advanced Clean Cars*

Sustainable Communities and Other Vehicle Miles Traveled Reduction Strategies

In many ways, SB 375 provided a gust of wind to planning coordination efforts that had already begun prior to the law's passage in 2008. In combination with the goals and procedures outlined in SB 375, that change represents a paradigm shift in how traditional transportation, land use, and housing planning is conducted and continuing those efforts will be crucial to meeting future GHG reduction goals. Each of the MPOs' SCSs completed thus far demonstrate a comprehensive shift away from business-as-usual planning, resulting in per capita VMT reductions along with a host of additional benefits that improve the quality of life for Californians. By 2035, residents in the San Diego region will make nearly one third of their trips using a transportation mode other than driving alone. Changes in the Southern California housing stock, where two thirds of new housing will be multi-family by 2035, will provide residents with greater choice in the type of place to live. The Bay Area will experience a 20 percent increase in the region's share of car-free trips by the year 2040. In the Sacramento region, jobs located within high-frequency transit areas will more than double by 2035, making it easier for commuters to get to work. These are just a few examples of the ways that improved regional planning in coordination with local governments will reduce per-capita VMT and support vibrant, livable communities.

SB 375 has provided a new planning framework wherein regional and local governments integrate efforts to improve land use and transportation decisions in support of the State's GHG emission reductions by lowering vehicle miles traveled. As often as every four years, but at least every eight years, ARB is tasked with revisiting the 2020 and 2035 GHG emission reduction targets that it first set in 2010. ARB is

currently limited to setting GHG emission reduction targets for the years 2020 and 2035. Beyond 2035, additional legislation will be needed to set targets that specifically link GHG emission reductions to sustainable community planning or VMT reduction. As SCSs are developed, agencies should ensure strong equity and environmental justice metrics are included, jobs-fit-housing modeling is incorporated, and policies mitigate and protect low-income residents from displacement.

Continuing the progress in reducing per capita VMT is critical but maintaining and improving upon this trend is necessary and will require more effort. Because of the long-term nature of transportation planning and implementation, decisions being made now affect future transportation and land use decisions. For example, Regional Transportation Plans consider at least a 20-year planning horizon, and over the next 10 years all MPOs will need to address planning for years 2035 to 2050. It is reasonable to expect MPOs to continue embedding SCS strategies into future planning efforts. To further the progress being made, a number of strategies already shown to lower VMT will need to continue to be implemented and expanded; additional work on refining the understanding of the relationships of these strategies to VMT reductions will need to be completed; and new strategies will need to be developed. These strategies include, but are not limited to: promoting equitable transit-oriented and infill developments; ensuring equity-improving mobility options; and increasing transit connectivity, active transportation options, public education, and travel demand measures.

As agencies implement these strategies they should develop ways to reduce health disparities within vulnerable communities and consider the unintended consequences associated with increased housing demand and the risk of displacement of lower-income households. In many high-demand metropolitan areas, repurposing existing buildings and redeveloping abandoned or underdeveloped sites at higher densities, often in economically disadvantaged areas, is fueling strong competition for varied housing types and availability, inflating land values and ultimately impacting housing affordability. Increasing land values in response to new transit-oriented development without policies in place to manage displacement risk impacts lower income households to a greater degree and increases the risk of community destabilization. Research reveals that increasing land values around a new transit station can trigger unintended consequences, such as higher increased rents and housing prices and reduced transit ridership compared to surrounding metro areas with lower income households located proximate to transit[7]. Thus, preserving existing affordable housing and services in transit-rich locations is important.

Additionally, lower income households displaced to transit-poor locations farther from employment and services may incur additional costs associated with vehicle ownership. Displaced transit-user households acquiring a car to access employment and services add to overall emissions while reducing resources available for necessities. Land use and housing strategies that encourage owner/renter ratios and equitable sales/rents that

[7] Dukakis Center for Urban and Regional Policy, p. 23 & 25, 2010, *Maintaining Diversity in America's Transit-Rich Neighborhoods: Tools for Equitable Neighborhood Change*

mirror the existing or developing employment sector can preserve and expand the goods and services, employment, amenities, and tax base for existing communities.

Strategies for reducing per capita VMT include the following:

- Equitable Transit Oriented Development and Infill
  Equitable transit-oriented and infill developments represent the types of land use and transportation decisions that will be needed to accommodate population and economic growth in a manner consistent with GHG emission reduction goals, consumer preferences, and open space conservation. Transit-oriented developments capitalize on transit investments by developing retail, employment, and affordable residential uses accessible to good quality transit stops/stations. By locating destinations near transit, consumers and residents are provided with the choice to take transit, bike and /or walk to these easily accessible destinations. As TODs are developed it is important to maintain and enhance affordable housing that provides access to transit and jobs. Infill developments commonly face local resistance, including costly lawsuits. In order to expedite the proliferation of equitable TODs and other infill, it will be necessary to break through common barriers created by federal, State, regional, local, and private sector policies and practices on financing, environmental review, parking, and other issues. SB 743 (Steinberg, 2013) directs the Governor's Office of Planning and Research to craft a replacement methodology for "Level of Service" traffic mitigation, an important first step in moving to multi-modal solutions for infill development.

  Many policies and development conditions continue to incentivize detached single-family housing over higher-density, mixed-use developments. SB 375 added provisions intended to streamline the CEQA permitting process for areas that meet certain requirements, but it remains to be seen if those provisions alone will allow for the style of development necessary to meet the 2050 climate goals.

  Transit hubs record highest levels of ridership within a quarter to half mile radius. Increasing housing availability, especially affordable housing, within these areas could create zones where owning and maintaining a personal vehicle is not a necessity. Carless households represent lower transportation-related emissions in transit-oriented areas. Increased ridership is the foundation of new and expanded transit development. Location-efficient affordable housing has been estimated to minimize vehicle use, evidencing a 20-40 percent reduction in vehicle miles traveled[8]. As lower income households account for nearly one-third of all transit riders, and three quarters rely solely on public transportation the preservation and development of affordable housing is critical.

[8] U.S. Environmental Protection Agency, Smart Growth Program, p. 90, 2013, *Our Built and Natural Environments [2nd ed.]*

- Increased Mobility
  Transportation beyond 2035 will need to be defined not by the single occupant automobile but rather by a range of mobility choices. Strategies will need to include incentives for people to ride transit, car-share, carpool, walk, bicycle and rideshare. Many programs already exist to promote a shift away from solo automobile use, but reducing VMT beyond the 2020 and 2035 targets will require even more aggressive strategies to further reduce GHG emissions. In addition, California's demographic makeup is shifting in a way that will call for increased mobility options as the population grows more ethnically diverse and ages. Improving both transportation mobility and accessibility will benefit an aging population that requires access to services and desires to "age in place". Generation Y has shown a preference for driving fewer miles and there is an expectation that that trend will hold true as Generation Y transitions to childrearing years and beyond. The combination of those two demographic forces suggests that improved mobility will not just be a strategy to reduce GHGs, but also a response to changing lifestyles.

- Improved Transit Connectivity
  Many of the SCSs outline an increased role for transit in their regions' future. Regions are building new rail lines, developing bus rapid transit systems, and increasing local bus frequency. But, transit operators often narrowly define the transit experience as boarding and exiting a bus or rail car, while users consider their trips in terms of origin, destination, and everything in between. Current and potential transit riders can face inconveniences and even unsafe conditions during the door-to-door travel to their destination. Improving the entire transit experience while minimizing transfers, co-location of first/last-mile electric vehicle car share programs, and increasing availability of safe routes to transit would help increase transit ridership and better serve transit-dependent populations.

- Increased Active and Public Transportation
  A major expansion of active transport (such as biking and walking) and public transit are key to achieving California's GHG emission reduction goals. Walking, bicycling, as well as using public transit will need to be the modes of choice for a large share of short, urban trips currently taken in personal passenger vehicles. Strategies will need to be implemented so that active transport and public transit will be as convenient, affordable, safe, and time-efficient as driving. These include the construction of "complete streets", incentives for people to ride transit, and funding for transit operations that increase ridership. As part of the Governor's 2013-14 Budget, the Administration proposed creation of an Active Transportation Program to increase the number of trips achieved through biking and walking. The Active Transportation Program was enacted by Senate Bill 99 in September 2013.

- Public Education and Travel Demand Measures
  There are a number of personal choices Californians can take to help reduce commute related VMT. Innovative technology and communications solutions to

help facilitate improved telecommuting and teleconferencing options will provide employers and employees with the ability to cut down on VMT. Continuing to promote employer-based transportation solutions such as facilitated carpooling and parking cash out would allow employees more options to reduce commute-related VMT. Commuter benefit ordinances provide employees with reduced commute costs by requiring employers to offer incentives for biking, transit, ridesharing and walking.

Implementation of the strategies identified in the adopted SCSs and other local plans provides an opportunity to conduct research to ensure the strategies are effective in reducing GHG emissions and implemented in an equitable manner. The most effective strategies will be used as the foundation for future planning efforts.

Passenger Vehicle Technology Improvements

To achieve the long-term emission targets in California, passenger travel will require a nearly complete shift to vehicle electrification (electricity and hydrogen), along with continued advances in the efficiency and performance of conventional vehicles. This shift is particularly important in personal light-duty vehicles given the sector's large share of the emissions inventory. For light-duty vehicles specifically, the market will need to include a mix of alternatives, including a growing share of full battery and fuel cell electric vehicles, plug-in hybrid electric vehicles driven primarily in electric mode, and conventional hybrid vehicles for the heavier vehicles in this category. All of these alternatives are in the market today but at scales smaller than what will be needed in the future. This market transformation will need to go well beyond the existing Zero Emission Vehicle Regulation for 2025, and will need strong consumer demand and industry innovation. To support consumer acceptance, the State currently provides vehicle purchase incentives for many of these technologies and most recently the Governor's Proposed Fiscal Year 2014-15 Budget identified up to $200 million in funding for low-carbon transportation specifically including these technologies. Public investment in some form will need to continue until these vehicles reach full commercialization. In addition, a campaign to push for higher vehicle efficiencies and advancements in a wide range of policies and technologies should include engines and transmissions, batteries, vehicle weight reduction, lower-rolling resistance tires, vehicle aerodynamics, and more efficient vehicle accessories. New California policies targeting lower GHG emissions and more fuel efficient vehicles can also result in significant co-benefits for achieving upcoming ozone standards. As these policies and public investments are being implemented, agencies should ensure access to the vehicle alternatives for low-income households and small businesses.

The battery and fuel cell technologies are evolving rapidly and will result in improved electric vehicles for consumers. In combination, the two technologies can be the no compromise solution for replacing internal combustion engines while fully meeting all consumer expectations of convenience and range. With a few exceptions, today's battery technology limits the electric driving range of battery electric vehicles to below 100 miles per charge and plug-in hybrid electric vehicles to below 40 electric-only miles.

Within a few years, this will improve as the next generation batteries enter the market, appealing to a wider range of consumers. Fuel cell vehicle technology will be mature enough for commercial introduction as early as 2015, with fuel cell electric vehicles on the market today in limited volumes through leases. However, current infrastructure availability hampers their market potential. Additional public and private investment is essential to address the remaining barriers to get to 100 hydrogen refueling stations in California – the target number of stations needed to take the early market to a tipping point where normal investment will sustain infrastructure deployment that matches vehicle sales.

To a large extent, the transformation of the transportation sector will depend on consumer demand and choice in the market, so comprehensive public outreach and education on how individual choices impact the transportation system will be a key component of the strategy. The economically efficient transition to zero emission and other advanced technology vehicles will occur as consumers see increasing value in those vehicles. Consumer willingness to embrace the new vehicle technologies will grow as technology costs decline, vehicle choice becomes more prolific and attractive, and "total cost of ownership" factors favor clean vehicles (e.g., fuel savings). Given the urgency of the necessary transition, policy measures will be needed to increase incentives in varying forms and decrease operating costs. In addition to financial incentives, other equally effective incentives can take the form HOV lane access, preferential parking, among other approaches. Operating cost factors include the cost savings in switching to electricity or hydrogen, as well as potential future revenue streams from providing energy services to the grid.

The future will also include greater integration of grid energy services with vehicles, used for transportation. "Vehicle-grid Integration" will provide benefits to utility grid management as more of the transportation system transitions to electricity. Emerging electric grid policies include vehicle electrification, time-of-day pricing, and load demand management. In the future, transportation electricity will be an integral part of the grid management, creating new opportunities for smart grid flexibility. The supply of electricity and hydrogen will need to become largely decarbonized, moving well beyond the existing policies set for 2020. This topic is discussed further in following sections.

In the short-term, improvements can be made to the efficiency of in-use vehicles including deployment of fuel efficient passenger vehicle replacement tires. Deployment could include limited incentives, followed by ratings and then standard setting to permanently shift the market.

Passenger Rail Technology Improvements

Providing viable, quality interregional rail transportation through rail modernization in California will increase benefits for existing passengers, including improved mobility and safety, with a reduced carbon footprint and attract new riders. High-Speed rail, which serves as a spine for improved statewide rail service, will reduce GHG emissions by providing a cleaner alternative to air and private car travel and is projected to show a

reduction in emissions its first year in operation, with annual increases in emission reductions as the system continues to expand[9]. In advance of and as preparation for high-speed rail, regional and urban rail providers will be better integrated through schedule and fair integration with each other and with high-speed rail. Increased service, speed, and amenities will grow this mode of travel and—due to station locations—encourage TOD and infill. In addition, activities such as positive train control enable safer, more efficient rail transport.

Passenger rail vehicles, such as those requested recently through a joint bid between the Authority and Amtrak, will be modern, electric, state-of-the art high-speed trainsets. These highly efficient trainsets include regenerative breaking technology, which returns breaking energy to the trainset or the propulsion system, reducing overall energy loads. By procuring renewable energy for the high-speed rail system, the Authority can provide zero emissions passenger rail service.

Existing Roadway Network Improvements

Making the existing transportation system more efficient will achieve a tangible benefit to GHG emission reductions over the next 20 years make more efficient use of the state-owned 50,000 miles, while reducing the pressure on new highway expansion.

- <u>Operational</u>
  Some of the possible operational improvement strategies that could be employed or expanded to reduce transportation related GHG emissions on the existing transportation system include the following:

  - Active Transportation – Increasing dedicated local road space for active transportation (separated bikeways, wider sidewalks, etc.)
  - Traffic Control – includes activities such as arterial signal control and optimizing traffic flow through traffic light synchronization.
  - Transportation Management Systems (TMS) / Intelligent Transportation Systems (ITS) – includes detection, incident management, arterial signal coordination, ramp metering, and traveler information.
  - New Vehicle Technologies – includes autonomous vehicle systems and the use of adaptive cruise control, GPS, and camera technologies to enable truck platooning.
  - Other – includes non-capacity increasing projects, auxiliary lanes, turn lanes, truck lanes (climbing or separated flow), and HOV and HOT lanes.

- <u>Pavement</u>
  The condition of the actual roadway surface affects vehicle fuel consumption and the amount of GHG emissions. Research shows that smoother roadway surfaces play a role in GHG emission reductions.

[9] Contribution of the High-Speed Rail Program to Reducing California's Greenhouse Gas Emission Levels http://www.hsr.ca.gov/docs/programs/green_practices/HSR_Reducing_CA_GHG_Emissions_2013.pdf

In addition to the actual condition of the pavement surface, the type of pavement also plays a role in GHG emissions. There are two primary types of pavement materials: concrete and asphalt. Both materials have their own qualities and applications. Concrete is lighter in color and thus absorbs less heat, and depending on conditions, has a longer service life. Asphalt is the most commonly used paving material and less expensive.

The manufacturing process of concrete can produce significant levels of GHG emissions due to the cement used as a binding agent. Concrete manufacturers can produce less GHG intensive concrete by substituting other binding materials such as fly ash or blast furnace slag. Caltrans is developing specifications for "cool pavements" that can help to minimize urban heat island effect[10]. There are also methods to reduce the GHG emissions from asphalt. On average, the use of cold-in-place recycling and full depth reclamation reduces GHG emissions associated with the installation of an asphalt pavement surface by up to 90 percent when compared with conventional methods.

2) Freight Transportation – *California Freight Mobility Plan and Sustainable Freight Initiative*

To meet an 80 percent GHG emission reduction target by 2050, freight will need to be moved more efficiently and with zero or near-zero emissions wherever possible. The solution will require technology innovation including: development and deployment of zero and near-zero emission engines for trucks, locomotives, cargo handling equipment and ships; lower-emission aircraft; parallel development of the necessary supporting infrastructure; and logistical/operational efficiency improvements to reduce VMT. These same strategies have an equally important role in reducing diesel soot and nitrogen oxides that form regional ozone and fine particles. Recognizing that freight transport plays a key role in California's economy, the strategies must be implemented in a way that improves California's competitiveness, providing reliable velocity and expanded system capacity, while integrating with the national and international freight transportation system. However, implementation of the strategies should consider accessibility and affordability to small businesses, independent owner-operators, and rural communities when applicable.

A major focus for ARB over the next several years is the development of a Sustainable Freight Initiative (Initiative) which is a broad, multi-decade effort to develop, fund, and implement the changes necessary to achieve a sustainable freight system. The 2014 Sustainable Freight Strategy (Strategy) is a concentrated, one-year effort to produce a document developed in the context of the broader Initiative and represents the next milestone in defining what is necessary to move California toward a sustainable freight system, building on the vision presented below. Fostering a coalition of freight stakeholders is a primary focus of the Strategy, and will ultimately be a significant driving force behind affecting change in areas outside of ARB's sphere of influence,

[10] The term "heat island" refers to warmer urban air and surface temperatures that result when natural landscape is replaced with hardscape surfaces such as pavement, buildings and other infrastructure.

including advocating at the federal level and acquiring public and private funding for implementation. Complementary efforts to identify a future vision for California's freight system are being carried out by regional transportation planning agencies through their Regional Transportation Plans and Caltrans through the California Freight Mobility Plan development process. ARB's Strategy will integrate closely with these efforts.

Vehicles and Equipment

By 2050, freight transport fleet will need to be zero-emitting wherever feasible. In cases where it will not be possible to replace internal combustion engines, engines will need to be significantly lower-emitting and fueled with low carbon renewable fuel. In some cases, these engines may be able to operate in zero emission mode for part of their duty cycles. The vision includes:

- <u>Zero emission trucks in local and high use freight corridors</u>
  Zero emission technologies for trucks include battery-powered electric motors, wayside powered electric motors (e.g., catenary or in-road power), or hydrogen fuel cell powered trucks. Each of these technologies has progressed at least to the demonstration phase, and in the case of smaller trucks, battery-powered vehicles are available commercially in small volumes. However, near-term challenges exist either in terms of cost, vehicle range, payload, and the need for associated infrastructure. Continued investment though demonstration and deployment projects will determine which technology or combination of technologies holds the most promise for long-term deployment for different truck categories and duty cycles. Over time, the proven technologies will be well suited for initial large-scale introduction to local routes and high-use freight corridors such as the routes emanating from the ports.

- <u>Zero and near-zero emission trucks statewide</u>
  Practical zero emission technology for longer-haul trucks (such as hydrogen fuel cells) is less developed and presents additional challenges integrating into a nationwide fueling infrastructure. Investment in research and demonstrations will help determine the viability of the technology and identify appropriate uses. However, it may not be feasible for longer-haul trucks to be fully zero emission. In these cases, we envision lower-emitting advanced technology vehicles such as dual-mode trucks capable of operating in zero-emitting mode during part of their duty cycle. Dual-mode trucks could have sufficient battery power to operate in electric-only mode, but would also have an internal combustion engine that provides flexibility for longer routes. Another approach for dual-mode trucks would be the use of wayside power when available, or an internal combustion engine when operating away from wayside power.

  In any case, new standard-setting efforts for further efficiency improvements and reduction of GHG emissions from the heavy-duty sector will help catalyze renewed efforts towards a statewide zero and near-zero emission target. ARB is working with U.S. EPA and NHTSA on Phase 2 heavy-duty vehicle standards

with a goal of federal promulgation in 2015 and ARB consideration by 2016. These regulations would build on Phase 1 regulations to achieve additional GHG emission reductions

- Zero and near-zero emission freight locomotives
  As with the truck sector, a future rail sector operating with zero emissions in high-use freight corridors and operating with near-zero emissions statewide is envisioned for 2050 with significant penetration of advanced technology locomotives by 2035. Several technology categories that could be applied toward freight locomotives to achieve zero emission track miles include overhead catenary (with electric or dual-mode locomotives), battery-hybrid systems (capable of operating in zero emission mode during part of their duty cycle), and linear synchronous motor (LSM) technology. Catenary systems are the most extensively used today, although commonly in passenger train and light-rail applications. Electric freight locomotives are used in other countries, but electric locomotives would need to be engineered for use with trains of the size and length operated in the United States. A significant issue that would have to be addressed with catenary systems is how the transition would be made to non-electrified portions of the rail network given the interstate nature of the rail sector. In addition, because of the high cost and long life span of locomotive engines (up to 30 years), achieving rapid turnover to technologies not yet developed will be a challenge.

- Zero and near-zero emission cargo handling equipment
  Cargo handling equipment (such as yard tractors, forklifts, gantry cranes) will need to emit zero emissions wherever feasible by 2050. Technologies under development for on-road applications (battery-electric, fuel cell, hybrid electric) may be transferable to cargo handling equipment, with demonstrations of some of these technologies underway or under consideration. In some cases, grid-based electric powered equipment such as gantry cranes or automated cargo moving systems may be viable zero emission options.

- Cleaner marine vessels
  Marine vessels do not hold the promise for full electrification that land-based equipment do; however, there is potential for cleaner, more efficient engines, cleaner, lower-carbon fuel, and use of shore-side electricity (instead of ships' auxiliary engines) to power ships while in berth for loading and unloading of cargo. ARB already has a regulation in place requiring use of shore side power for frequently visiting ships as noted in the *Progress to Date* section, and hybrid tug boats are already being demonstrated. The Ports of Los Angeles and Long Beach have programs in place to incentivize shippers to send their cleanest vessels to California ports via lower docking fees for the cleanest vessels. Mechanisms to attract cleaner, more efficient ships to California should be part of the longer-term control strategy. Ultimately, cleaning up the cargo ship fleet will be dependent on international efforts and the penetration of cleaner, more efficient ships into the fleet.

Improved Logistics and Operational Efficiencies

Improved logistics and improved technology and operational efficiencies reduce emissions by reducing VMT, fuel consumption, vehicle and equipment idling times, and cargo handling emissions. The cargo industry has a natural economic incentive to continually improve the efficiency of its operations in order to save money and transport goods to market more quickly. However, government has a role to play in infrastructure improvements and strategy demonstrations to make the system more efficient. In addition, collaboration across the California-Mexico border needs to encourage the reduced idling of trucks making those trips.

Community-Based Strategies

Community-based strategies have the potential to also reduce freight transport emissions. One example is the use of centralized package drop-off and pick-up. Another example is localized production of food and the manufacturing of other goods, which has the co-benefit of reducing VMT—and therefore emissions—related to the transport of those goods to market. California is the leading manufacturing state in the nation, and maintaining and increasing in-state manufacturing will be critical for meeting future emission reduction goals as well as maintaining a strong economy.

3) Low Carbon Fuels and Energy for Transportation – *Beyond 2020*

Low Carbon Fuel Standard

Transformation of the transportation sector will require significant changes to how California moves—from people to goods. Fuel policies complement the vehicle policy drivers mentioned above. The question then becomes, how do we make sure that we are providing rigorous enough fuels policies to help drive the demand for near-zero or zero emission fuels? Agile, performance-based policies—such as a Low Carbon Fuel Standard (LCFS)—have the potential to keep up with the fleet transitions while giving fuel providers ability to develop innovative, lower-emission production technologies to deliver the fuels.

The transition to low carbon fuels began in 2011, with the implementation of LCFS. As we move toward the goal of a ten percent carbon intensity reduction from transportation fuels by 2020, we are seeing a mix of liquid biofuels, natural gas, and a small amount of electricity being used in the marketplace. The use of these fuels and others will continue to grow as long as there are vehicles in the marketplace, progressive policies in place, regulatory certainty, and incentive programs that support research, development, and deployment.

While the LCFS has GHG emission reduction targets set only to 2020, the performance-based regulation provides an agile framework that can be extended beyond 2020 to meet the changing needs and goals of the transportation sector. The LCFS, which

depends on both the carbon intensity of the fuel and the efficiency of the vehicle using said fuel, can accommodate the lower-carbon fuels that are coming to market (which is, of course, dependent on the vehicles that are on the road). So while the LCFS may need to be extended beyond 2020 to better suit the regulated parties of the future, conceptually a performance-based program that rewards fuels based on their ability to reduce GHG and criteria pollutant emissions has promise to encourage and continue the necessary transitions needed to fuel transportation.

Fueling Infrastructure

The fueling infrastructure and community integration needs to be convenient and widespread. Alternative fueling infrastructure will need to expand along major travel corridors, accommodating varying travel profiles, including commuting trips and longer distance recreational trips. Careful planning for electricity and hydrogen infrastructure has and will involve State agencies, as well as local planners where corridors traverse between regions and states. An initial infrastructure is in place, including home charging for the majority of electric miles on plug-in vehicles, but a more robust infrastructure will need to evolve in the future. This will include widespread charging at workplace locations, charging in strategic public locations (e.g., shopping centers, hotels, multi-unit housing, etc.), multi-unit dwellings, and a modest network of fast chargers for long-distance trips. State and local policies can encourage the growth of this infrastructure through grants, performance standards, and streamlined local permitting and siting. In addition, the California Green Building Standards Code can provide options for new construction to include wiring necessary to accommodate electric vehicle charging stations. Hydrogen infrastructure, particularly, requires focused State policy support given the large commercial barriers that surround that fuel.

Vehicle-Grid Integration

The transformation of transportation to zero- or near-zero emission technologies will rely on varying amounts of electricity as a fuel, which may require capacity expansion. While it is expected that the necessary infrastructure expansion would come at some cost, data indicated that currently most vehicles charge at night, off-peak. In this way, daily load can be leveled and use of additional renewable resources (wind) can be achieved. The ability to forecast and schedule the charging or discharging of many PEVs could allow the vehicles to serve as flexible resources to help integrate intermittent sources of renewable energy, manage costs of grid operations, and moderate costs of any infrastructure expansions. Real-time energy pricing can play a role in encouraging charging at the most appropriate times. Vehicle-grid integration could offer a range of benefits to grid users, vehicle owners, utilities and system operators. For example, if an electric vehicle supply equipment host site (e.g., employer) controls charging, it may use vehicle-grid integration to control demand charges, system upgrades, etc. Separately, there may be opportunities for a limited number of sites to make use of vehicles' load and storage capabilities. Vehicle-grid integration will require development of supporting policies and regulatory mechanisms as well as a scalable demonstration involving a variety of plug-in vehicles and

customers. The California Independent System Operator in coordination with the Energy Commission released a Vehicle-Grid Integration Roadmap in February 2014[11].

Wayside Power for Freight

Significant infrastructure investments, both public and private, will be needed to support electrification of the freight transport fleet. This may include electrified truck lanes providing wayside power (e.g. catenary or in-road power) on major freight routes. The I-710 corridor in Southern California has been identified as high priority for introduction of zero emission technology. Wayside power will also be needed to support some of the locomotive and cargo handling strategies contemplated. Given the long timeframes for infrastructure development, infrastructure planning decisions will need to be made before some of the advanced technology vehicles and equipment are ready for mass commercialization. It will be a challenge to coordinate infrastructure development with advanced technology rollout.

IV. Recommended 5-Year Policy Priorities

The section builds upon the *System Outlook* section by identifying the key policy priorities and actions for State agencies to pursue over the next five years. With the long timeframes necessary to realize the full benefits from many of the strategies presented above, it is critical to start planning and implementing as soon as possible in order to put the State on the trajectory for reaching the 2032 air quality and 2050 climate change goals. As these actions and policies are implemented, they will need to be consistent with principles/criteria that ensure access, equity, and benefits to vulnerable communities.

We recommend prioritizing the following activities over the next five years:

- ARB, with local agencies, will coordinate with the development of the 2016 State Implementation Plans that focus on criteria pollutant emission requirements—ensuring State Implementation Plan strategies maximize reductions in GHG emissions as well as criteria pollutant emissions.

- Caltrans and ARB will coordinate on the development of the 2014 California Freight Mobility Plan and the 2040 California Transportation Plan to achieve GHG emission reductions.

Sustainable Communities and Passenger Transportation

- ARB will complete a technical review that will inform the need for an appropriate timing of revisions to the SB 375 regional targets established in 2010.

[11] http://www.caiso.com/Documents/Vehicle-GridIntegrationRoadmap.pdf

- Support regional and local implementation of SCSs by providing access to financial resources and incentives that are necessary to achieve the GHG reduction targets.

- SGC will support MPOs' development of SCSs that reduce GHG emissions:
    - Provide data and tools to increase MPO planning and modeling capacity.
    - Facilitate the sharing of best practices and lessons learned among MPOs.

- SGC will support local leadership to implement the strategies described herein:
    - Identify ongoing resources to incentivize local government planning activities that realize the State's climate change and sustainable community goals.
    - Compile, develop, and disseminate guidance and educational materials regarding local strategies to reduce GHG emissions in the transportation sector.

- SGC will develop guidance for State agencies to help ensure that State infrastructure spending is consistent with the State's Planning Priorities[12] and that these investments promote low-VMT development, where appropriate.

- HCD, through administration of the Regional Housing Needs Allocation (RHNA) and updated housing element certification, will support integrated transportation and housing development, offering more varied and efficient consumer choices.

- HCD will support implementation of SCSs and local plans for affordable infill and TOD, including provisions for active transportation, through administration of low interest loans and grants.

- Governor's Office of Planning and Research will develop new CEQA guidelines for infrastructure projects to increase transit use and active transportation.

- Caltrans will work with local agencies to implement SB 375 SCSs that reduce the emphasis on highway expansion and place new emphasis on maintenance of existing systems, expanded transit and active transportation.

- Caltrans and local agencies will invest in clean passenger transportation from public funding sources including cleaner transit with improved connectivity and active transportation.

- The Authority will complete construction of the initial operating segment of the high-speed rail system in the Central Valley and continue with construction

[12] The State's Planning Priorities can be found in California Government Code Section 65041.1

toward the Los Angeles basin to link the northern and southern parts of the State with electrified high-speed rail service.

- The Authority will implement the adopted net-zero greenhouse gas emission construction plan, urban forestry, and open-space and agricultural preservation.

- The Authority will procure renewable energy to test, commission, and operate the high-speed rail system.

- The Authority will provide tools and planning funding resources to local jurisdictions to best capitalize on high-speed rail stations as a catalyst for community economic development, including sustainable infill development.

- The Authority and Caltrans will support regional and urban rail providers in modernizing rail, such as the electrification of Caltrain, and other infrastructure improvements that will result in growing rail ridership on clean, energy-efficient trains.

- The Authority and Caltrans will support the integration of rail and transit operators, through better-coordinated scheduling, ticketing, and navigation so that ridership will grow through faster and more convenient service.

- Caltrans will implement operational efficiency improvements within existing transportation system including, traffic control measures, transportation management and intelligent transportation systems.

- Caltrans will finalize and implement use of “cool pavement” specifications.

- ARB, with local agencies, will provide incentives for zero emission transit buses in strategically-located “Transit Centers of Excellence.” The purpose of the “Transit Centers of Excellence” is to enable large-scale demonstrations of zero emission buses with a deployment goal of 40 buses per center. These efforts will be complementary to ARB’s Zero Emission Bus regulation.

- ARB and the Energy Commission will support expanding markets for zero emission passenger vehicles by continuing State incentives and further implementation of the *ZEV Action Plan*.

- ARB will explore additional vehicle fleet efficiency improvements and further GHG reductions beyond 2025 informed by the 2017 mid-term review of the Advanced Clean Cars program.

- CEC supports research to help make electric vehicles more cost competitive with conventional vehicles such as battery recycling, battery standardization, and second use.

- ARB will pursue the following research:
    - Research and review of light-duty zero emission vehicle market for the U.S. GHG/CAFE mid-term review of the 2017-2025 standards in the Advanced Clean Cars program.
    - Data analysis that support emissions inventory improvements to better evaluate the efficacy of emission reduction strategies.
    - Research on the efficacy of SCS strategies and how they can be implemented more equitably.

- CPUC, the Energy Commission, and ARB will pursue the following research:
    - Research to understand the charging/fueling behavior of fleet and residential ZEV drivers. This research will help us understand the evolving infrastructure needs of different ZEV applications.

Freight Transportation

- ARB will develop the 2014 *Sustainable Freight Strategy* that will identify a clear vision and broad-based coalition to develop, fund, and implement a sustainable freight system. The *Strategy* will provide further detail to the vision presented in this document. ARB will work closely with air quality, transportation, and energy agencies at the State, local, and federal levels; cargo owners, including key importers and exporters; the freight transportation industry (ports/marine, rail, trucking, air cargo, warehousing and distribution); business and economic development leaders; environmental and community organizations; academics/researchers; and labor and workforce development interests.

- ARB, with local agencies, should provide funding for advanced technology demonstration projects and pilot deployments of freight transport and other vehicles and equipment. Focus areas for these projects include, but are not limited to: zero emission port trucks for near-dock rail pilot projects; pilot projects to deploy zero emission and hybrid vehicles and equipment at distribution centers located in areas most impacted by air pollution; development and demonstration of advanced technology locomotive, marine vessels, port yard trucks, and other cargo handling equipment.

- ARB will engage the Governor's Office of Planning and Research to expand upon the *ZEV Action Plan* for medium and heavy-duty trucks.

- ARB, with the Energy Commission and Caltrans, will identify infrastructure needs to support full scale deployment of the advanced technologies that show the most promise in the demonstration and pilot phase. These will be coordinated with transportation planning agencies to incorporate into future State and regional plans.

- ARB, with local agencies, will support demonstration programs and evaluate funding and regulatory options for full deployment of zero emission trucks

transporting containers between the ports and near-dock rail yards in South Coast Air Basin by 2020.

- Caltrans, ARB, and local agencies will provide resources and funding to ensure zero emission truck-only lanes along the I-710 corridor expansion in Southern California.

- ARB will identify funding for a fleet of advanced technology hybrid demonstration vehicles in the San Joaquin Valley to demonstrate viability of technology in non-dense urban environments where vehicle routes and duty cycles may not be conducive to full electrification.

- ARB and the Energy Commission will support expanding markets for high-efficiency trucks and equipment by continuing State incentives, refining certification procedures, establishing performance standards, and conducting technology demonstrations of the next generation high-efficiency trucks that incorporate greater chassis integration and system design optimization.

- ARB, along with U.S. EPA and NHTSA, will expand upon the existing “Phase I” GHG heavy-duty truck emission standards with a proposed “Phase 2” standard to achieve additional GHG emission reductions for trucks.

- ARB will support development through data collection and sharing of a data/information clearinghouse to provide fleets with better hybrid and zero emission truck performance data in real world usage to validate the reliability and business case of the vehicles, including guidance regarding best usage profiles.

- CEC will continue to support research that advances medium- and heavy-duty natural gas engine and storage technologies, as well as hybridization technologies that will reduce emissions and improve performance.

- ARB will pursue the following research:
    - Data analysis that support emissions inventory improvements to better evaluate the efficacy of targeted regional, corridor or vocation-specific strategies.
    - Evaluate potential for near-term GHG emission reductions through enhanced driver training, real-time vehicle feedback mechanisms, and other in-use approaches.
    - Evaluate the operational challenges associated with integration of the zero and near-zero emission rail technologies with the national rail network, and begin infrastructure planning.

Low Carbon Fuels and Energy for Transportation

- ARB will continue to implement and enforce the Low Carbon Fuel Standard.
- ARB will consider extending the Low Carbon Fuel Standard beyond 2020.
- CPUC, the Energy Commission, and ARB will support commercial markets for low-carbon transportation fuels and energy through policy considerations, such as setting reasonable rates for electricity service that encourage electrification.
- ARB and the Energy Commission will continue to evaluate the benefits and availability of renewable transportation fuels.
- CPUC and the Energy Commission will provide support for vehicle-grid integration through policy development and technology demonstrations. Greater vehicle-grid integration will require regulations defining the market roles for customers, service providers, and utilities; research into customer participation; and pilot programs that evaluate technological and economic viability.
- ARB, the Energy Commission, California Department of Food and Agriculture, and CPUC will provide support for low-carbon fuels through: 1) continued funding, if available, for infrastructure; 2) development and adoption of performance and quality standards; and 3) streamlined local permitting, siting, and utility interconnection.
- ARB and CPUC will support plug-in vehicle charging rates that strongly encourage off-peak charging both at home and at public chargers or are responsible to grid operational needs.
- ARB and the Energy Commission will evaluate funding options, regulatory options and policy needs to support development of large-scale and low-carbon production facilities.
- ARB will support CPUC efforts to finalize rules allowing bio methane injection into natural gas pipelines.
- ARB will assess the role of natural gas in the low-carbon transportation fuel future.
- ARB will pursue the following research:
    - Evaluate reactivity of and leak rates from CNG and LNG heavy-duty vehicles.
    - Evaluate the capability of the existing and planned natural gas fueling infrastructure to be utilized for hydrogen distribution.

Appendix C - Focus Group Working Papers

Agriculture Working Paper

Introduction

Agriculture is an important resource for California, providing a safe, reliable, and affordable food source to support growing local, national, and global populations. It is also a key economic driver in the state. California has a range of climatic regions that allow for the production of a diverse variety of annual crops, such as vegetables and grains, perennial crops such as fruits and nuts, as well as livestock and dairy products. One tradeoff from agricultural food production is the release of greenhouse gases (GHGs) into the atmosphere. On a national scale, agriculture contributes approximately 6 percent of total GHG emissions (USDA 2011; Olander et al., 2011). The same levels apply for California - agriculture is responsible for approximately 6 percent of total inventory according to the California Air Resources Board. The primary GHG emissions from agriculture include methane (CH_4), carbon dioxide (CO_2), and nitrous oxide (N_2O). The global warming potential of CH_4 and N_2O is 21 and 310 times that of CO_2, respectively.

According to a recent report titled "Solutions from the Land: Developing a New Vision for U.S. Agriculture, Forestry, and Conservation", in 2050, U.S. farmers and ranchers will need to manage land to produce the food, fiber, and energy needed to support a growing population while simultaneously protecting and improving biodiversity and the health of the environment. The report goes on to note that land management must take into account a wide range of goals that address both food production and environmental sustainability. Environmental sustainability includes mitigating any GHGs from agriculture and also using agriculture to offset climate change through methods such as biological carbon sequestration – the natural process of plants absorbing CO_2 from the atmosphere and storing it in soil and plants.

It is in the best-interest of California's agricultural sector to identify and implement opportunities to mitigate GHGs since several documents, reports, and scientific publications have found that the impacts to agriculture from climate change and associated extreme events could impact both food production capacity and economics (Boicourt and Johnson, 2010; Maximilian et al., 2006; Medellin-Azuara et al., 2011; Jackson et al., 2011). In the 2009 Adaptation Strategy report for the State, rising temperatures, a reduction in water resources, and increased plant pests and disease pressures are among the impacts that threaten California agriculture in the future. Further, research has shown that as atmospheric CO_2 concentrations increase, nitrate (a key plant nutrient) assimilation may decline, consequently impacting protein content and food quality (Bloom, 2009). In addition, recent research has shown that certain regions of California will have potentially significant effects or changes to crop production (Sato et al., 2000; Ziska et al., 1997; deJong 2005; Hayhoe et al. 2004) as temperatures increase 1.3-2.0℃ by 2050, depending on the level of carbon in the atmosphere (Cayan et al., 2009). Therefore, addressing GHGs from various sources, including agriculture is critical to the future sustainability of agriculture as a food production and key economic sector in California. There are opportunities for the

agriculture sector in California to limit its GHG emissions in the future through mitigation efforts. In addition, agriculture can play a critical role with enormous opportunities to increase biological carbon sequestration in both vegetation and soils (i.e., rangelands), thereby reducing GHG concentrations in the atmosphere. Like the natural and working lands sector, optimizing carbon storage opportunities in the agricultural sector will be a key strategy to help California achieve its aggressive 2050 carbon reduction goal of reducing GHGs 80 percent below 1990 levels.

This paper discusses the potential for the agricultural sector to reduce GHGs in the future through 2050. To understand the GHG reduction potential and strategies for the agricultural sector for this time period, a baseline for the sector must be established. Analysis of the current California agriculture facts and figures will provide guidance. This baseline can be used to project a "mid-term and long-term "vision". Identifying how climate change mitigation measures fit into the vision is the purpose of this document. A similar approach has been adopted by Sumner (2013) in a document titled "Agricultural outlook for California to 2030."

Establishing a baseline – California's agriculture sector in 2011

According to national statistics on California agriculture, the State's 81,500 farms and ranches received a record $43.5 billion for their output in 2011. The revenue was led by the dairy industry. Other large revenue producers include almonds, grapes, cattle, plant nursery, berries, hay, lettuce, walnuts and tomatoes followed by numerous other crops. The state produces about half of the fruits, nuts, and vegetables grown in the U.S. The top 5 counties for agricultural production in the State are Fresno, Tulare, Kern, Merced, and Monterey (USDA NAAS, 2012). Additional baseline information on California agriculture is provided by Sumner (2013).

Agricultural production acreage in California accounts for 25 percent of its landmass: a little over 25 million acres. Approximately 75 percent of farms in the State are less than 100 acres while another 15 percent are farms that range between 100 and 500 acres. Almost half of all farms had sales less than $10,000 while about 70 percent of total farms had sales of less than $50,000. Close to 80 percent of all farms in California are family-owned and operated (USDA ERS, 2013). A 3.5 percent decrease in farmland was observed from 1997 to 2007.

The population of the state continues to increase and has doubled in size since 1980. The population in 1980 and 2012 were 23.6 and 37 million people, respectively. Much of the population growth has occurred in urban areas of California and is expected to continue to grow in the future (USDA ERS, 2013). This upward trend in population growth is expected to continue from the current 37 million to between 42 and 48 million by 2025 (PPIC, 2008).

Agricultural efficiency, in terms of food production per unit animal or crop acre, continues to increase through methods such as precision agriculture. The fundamental

question is how and what will agriculture look like in the future and how does GHG mitigation fit into an agricultural vision through 2050.

California's Agricultural Sector in 2050

Agriculture in California is and has been a foundational sector of the social and economic aspects of the state and must continue to play an important role through 2050. Several documents and reports have established a framework of agricultural sustainability for the 21st century. California Agricultural Vision or Ag Vision was conceived by the California Department of Food and Agriculture and the State Board of Food and Agriculture to address future sustainability challenges including climate change impacts and mitigation (Ag Vision, 2010). This report recognizes that, "The central challenge to agriculture in the 21st century is to achieve and sustain the capacity to feed a growing global population that is expected to reach nine billion people by 2050. As one of only five Mediterranean growing regions on Earth, California is a major contributor to the global food supply, particularly of nutritious fruits, nuts, vegetables and dairy products". Ag Vision identifies fundamental features of present-day agricultural systems that need to be maintained or enhanced into 2050. Strategy 9 of Ag Vision discusses climate change and the fact that mitigation of GHG is important to the sector's sustainability in the future.

This update report provides a discussion, focused on agriculture in the future, and explores potential mitigation solutions for GHGs as well as increases for biological carbon sequestration. The discussion is divided into three primary topics: crop production, animal production, and other considerations. The potential reductions of GHG from each topic are discussed along with specific methods of achieving GHG reductions in the future. In general, a range of on-farm management practices can help to reduce GHG emissions and sequester carbon. The adoption of these management practices primarily depends on agro-economic and on-farm feasibility as well as a host of other issues discussed (e.g., agricultural support services, incentives for management practice adoption, research activities). Incentivizing the implementation and long term maintenance of the management practices to reduce GHGs in agriculture will facilitate adoption by growers.

Crop Production

California has extensive annual row crops (e.g., lettuce, tomatoes, broccoli) and perennial crops (e.g., almonds, pistachios, citrus) which demonstrate the diversity of crops grown in the state.

Within crop production, several important aspects of the sector should be maintained or enhanced into through 2050. The USDA compiles ten-year agricultural projections for production, value, and acreage on a national basis for several crops. These projections provide a general overview, and should be used cautiously, since they are based on national data. However, some information is applicable to California agriculture since it is the dominant producer of certain crops. A good example is tree nut production which is expected to increase by 20 percent as prices also are projected to increase. A more

detailed summary of future projections and a snapshot of agriculture crops in California at present is provided by Sumner (2013).

There are several other strategies for the agricultural sector in California that should also be maintained (e.g., food safety) in the future and are referenced in documents such as Ag Vision but are not discussed in this report since they do not directly contribute to GHG emissions and mitigation measures.

1. Soil quality and heath

Soil quality and health is a fundamental component of California agriculture. The numerous benefits of soil with sufficient levels of organic matter are well understood. Ag Vision recognizes the importance of preserving farmland for agricultural food production. A list of potential mitigation measures for croplands in California is provided by Culman et al (2013). Considering the management activities in recent reports, such as Culman et al (2013) and those described below, will ensure the sector reduces GHG while maintaining its economic and social benefits into 2050.

Agricultural Land Conservation

Recent research has shown that GHG emissions are approximately 70 times greater from urban regions than agricultural lands (Jackson et al., 2012). Therefore, protecting and conserving agricultural lands from residential, commercial, and industrial use offers climate change mitigation benefits. Since agricultural lands also emit GHGs, efforts to reduce GHGs from managing these lands are critical. As population increases in the state from the current 37 million to between 42 and 48 million in year 2025 (PPIC, 2008), maintaining agricultural lands as a GHG carbon mitigation sink will be important through 2050. A summary report on GHG reduction opportunities in croplands in California by Culman et al (2013) notes that “recent reports highlight the importance of farmland preservation as a key strategy for stabilizing and reducing California’s future greenhouse emissions across multiple economic sectors”.

Tillage

Historically, tilling (loosening and turning) of soil has been a fundamental agricultural practice since there are numerous agronomic benefits such as: suppression of weeds and loosening of compacted clay soils. However, soil tillage also releases large quantities of carbon dioxide (CO_2) into the atmosphere. Several alternative methods, including changing tillage or cropping patterns, have shown to reduce the release of GHGs while maintaining crop yields. These specific methods are summarized in a recent report by Culman et al (2013). There is more research information needed on tillage practices for California (Suddick et al., 2010). Presently, a concentrated research effort is underway to identify which conservation tillage methods can be practically applied to California’s diverse crop systems since tillage management practices were developed for non-specialty crops grown in other U.S. States. Recent research has shown that the use of conservation tillage practices is growing in California but adoption is relatively slow in annual crops (Culman et al., 2013). Built-in

incentives and operational cost savings are required for wider adoption (Meadows, 2006; Gryze et al., 2009; Mitchell et al., 2009). Recent research has shown that conservation tillage offers numerous co-benefits in addition to GHG reduction: less tillage equates to fewer tractor passes and, therefore, cost savings in fuel, reduction of particulate (dust) emissions and further GHG reductions (Suddick et al., 2010). Cultural practices to adopt tillage must also be examined since; currently only about 10 percent of total crop acreage in California is under conservation tillage (Suddick et al., 2010).

Carbon Sequestration

Biological soil carbon sequestration or the capture of gaseous carbon from the atmosphere into soils is a process that can play a critical role reducing GHGs from agriculture to help meet our mid-term and long-term goals. There are numerous methodologies associated with building carbon in soils and some are under investigation through research efforts to quantify the benefits.

Cover crops have been shown to build biomass in fields, increasing total primary productivity and increasing soil carbon sequestration. Similar to tillage management, winter cover crops offer multiple benefits including reduced nitrogen fertilizer use and reduced N_2O emissions (Alluvione et al. 2010; Delgado et al. 2007; Gregorich et al. 2005). Recent annual crop research has shown that cover crops can provide organic matter inputs, benefiting soil health and increasing the carbon pools (Veenstra et al., 2007). Winter cover crops also offer other co-benefits, such as nitrogen fixation, leading to potentially less nitrogen use, and reduced sediment and nutrient runoff during winter months (Griffin et al., 2000). Much of the data to-date has been focused on annual row crops but perennial crops should be investigated as well.

Several other methods of carbon capture, using existing agronomic methods (e.g., organic farming), have been discussed in the literature and include building of organic matter pools by application of composted stable organic matter to farms and rangelands (Silver et al. 2010). The low decomposition rates of biochar carbon (defined as carbon-rich product from pyrolyzing biomass – Biederman and Harpole, 2013) may yield net GHG mitigation benefits. Recent studies suggest additional potential GHG benefits from biochar, including reduced N_2O emissions (Singh et al. 2010; Taghizadeh-Toosi et al. 2011), replacement of fossil fuels (Woolf et al. 2010) and reduced nitrogen fertilizer requirements (Lehmann et al. 2003). Sequestration of carbon in soils provides almost 90 percent of the global potential for agricultural mitigation (Smith et al. 2008).

Biofuels

Certain agricultural crops can be used to produce fuels (e.g., corn). Although, fuels derived from plant matter or biofuels eventually produce CO_2, there is no net addition of CO_2 to the atmosphere since it is re-captured by plants during its

growth cycle. Biofuel production is a renewable energy or bioenergy resource which reduces the reliance on fossil based fuels.

Bioenergy has been identified in the 2012 Bioenergy Action Plan (California Energy Commission, 2012) which is a multiagency coordination approach to address challenges and maximizing opportunities for the development of bioenergy projects that promote economic development and provide the greatest environmental benefit. The plan outlines state agency actions that: 1) stimulate cost-effective utilization of the state's diverse biomass resources for conversion to "low-carbon" biofuels, biogas, and renewable electricity; 2) increase research, development and demonstration of bioenergy toward commercializing new technologies; 3) streamline the regulatory and permitting processes; and 4) quantify and monetize the benefits of bioenergy.

Research efforts have already been initiated to identify crops for biofuel production in California. Advanced biofuels other than corn-based ethanol include ethanol derived from cellulose, hemicellulose, or lignin, sugar or starch (other than corn starch), waste materials, including crop residues, animal and food waste, biomass-based diesel, biogas, and butanol. The UC Davis Institute of Transportation Studies (Ogden and Anderson, 2011) concluded that advanced biofuels could provide significant environmental benefits and that the first commercial-scale biorefineries are expected to produce large quantities of advanced biofuels by 2015. If these technologies prove to be viable, rapid expansion could take place in the United States to meet the 2022 requirements of the Renewable Fuel Standard.

Conversion of plant matter to biofuels is expected to have a small GHG footprint. Biofuels can be used as an effective substitute for fossil based fuels which have a large GHG footprint and is not a renewable resource. Combustion of biomass in contained biomass-to-energy facilities, or conversion of crop residue to biofuels offers environmental advantages over in-field burning of crop residue. Specifically, processing of crop residue biomass in contained facilities results in capture of lost energy, and reduces GHG emissions and air pollution caused by in-field burning. Incentives and efforts to include crop residues (e.g., tree pruning's), into such processes, in a manner which reduces transportation associated GHG emissions, would be beneficial to mitigating burning events that add CO_2 to the atmosphere. However, biofuel production must be carefully evaluated and balanced so that food production and reliability is not compromised.

2. Irrigation water supply and conservation

Irrigation of crops in California is essential to food production. Crops require sufficient amounts of water throughout the growing season. California has a water delivery system that transports water to agricultural lands where production can be maintained (as opposed to rain-fed systems). The distribution network for water in California must

be maintained and enhanced to meet our mid-term and long-term goals. Adequate "supply" of water is also required to maintain and enhance agriculture in the future.

Irrigation methodologies

Effectively using and managing the water allocated to agriculture in the state is critical to the future success of the sector since water supplies and availability are directly connected to water use and management. Effective irrigation methods and technologies are needed to reduce N2O levels from agriculture fields. Several management practices have already been employed to establish effective irrigation that contribute to reducing GHGs. They include moving away from furrow or flood irrigation to precision irrigation methods such as drip and micro-sprinkler irrigation if compatible with the cropping system. These methods along with effective application of nitrogen fertilizers and compost can reduce future emission of GHGs in agriculture. Novel methods and techniques for irrigation will continue to be developed including the addition of organic matter and mulch for water retention purposes. For instance, field crops are not typically grown with drip irrigation but sub-surface drip irrigation has been used to effectively increase the yield of some field crops (e.g., tomatoes) where the economic returns and/or yield increases are sufficient to allow for a greater investment in advanced irrigation methods. Management practices that both increase yields while at the same time reducing GHGs will be more quickly adopted at the field level compared with management practices solely designed to reduce GHG without any other incentives to farmers.

Some cropping systems that require flooding contribute to CH_4 emissions (e.g., rice). Management practices are being developed to effectively reduce these GHG emissions from rice fields in California. The development of agricultural offset protocols could offer a level of quantification and verification since there are numerous components of the practice that need to be established, including research and data to support GHG mitigation benefits and measurement.

Water supply (see DWR write-up)

The California Department of Water Resources (CDWR) has predicted 25 percent reduction of the 15 million acre feet of snow pack storage in California by 2050 (CDWR, 2007). Methods such as precision agriculture and irrigation technologies to increase efficiency will play a role in maintaining adequate water supply. Additionally, methods to increase soil carbon and organic matter, through application of composted organic matter, have shown to improve the water-holding capacity of soil, helping conserve water and reducing runoff. Research from Australia (Recycled Organics Unit, The University of New South Wales, 2006) calculated potential water savings for grapes and cotton from using compost and mulch. In California, researchers at UC Riverside found that compost applications were "very effective in reducing water runoff," reducing total runoff by as much as 80 percent while improving the quality of that runoff. "Compost has the ability to absorb and store a considerable amount of water and concentrated nutrients," according to the researchers (Crohn, 2011), who also

noted compost's ability to conserve water where soils are damaged by human activity or erosion. There as numerous indirect benefits to water supply and conservation which lead to GHG mitigation (e.g., reduced fuel usage for irrigation water pumps).

3. Nitrogen management

Nitrogen is a critical nutrient central to all living systems including ensuring plant growth and food crop yields. Nitrogen is essential for many metabolic processes in plants and animals including formation of amino acids, which are the building blocks for protein. The human daily protein requirement ranges between 40 to 70 grams and is supplemented by crop and animal agriculture production. Nitrogen fertilizers are applied at sufficient quantities and under different chemical compositions to maintain economically viable food production systems in California. However, nitrogen fertilizers applied to crops also interact with soil microbes where ammonia and nitrates are transformed though nitrification and denitrification processes into N_2O. Nitrous oxide generation from crop nutrient management practices is the major GHG emission source from cropping systems. Two key factors in managing these emissions at the field level are the quantity of nitrogen (N) applied and the efficiency with which it is taken up by plants. Consequently, the nutrient management options focus on nitrogen application rates, timing, inhibitor application, and method of application (ICF International, 2013, IPNI, 2013). Effectively managing fertilizer use in the future will help mitigate this GHG from agriculture systems.

Fertilizer technologies

Slow release or polymer coated fertilizers are designed to release nitrogen at rates that are more conducive to plant uptake. Improvements in the design and application technology might contribute to reducing N_2O through 2050. Fertigation, or the application of fertilizer through drip irrigation systems, is a more controlled method of nitrogen application that is a well established management practice for specific crops. Management practices related to the method of application and timing for California's diverse crop industry will be needed in the future to limit N_2O gas emissions from agriculture.

Nitrification inhibitors

Nitrification inhibitors are chemicals that, when used with nitrogen-based fertilizers, can inhibit the conversion (or nitrification) of ammonium to nitrate, the main form of mobile nitrogen species in soils. The impact of nitrification inhibitors on N_2O emissions from agricultural soils is an active research area and there is strong and consistent scientific evidence that the use of nitrification inhibitors in some crops can reduce N_2O emissions by at least 30 percent while also increasing yields. Offset protocols have been developed by several organizations for inclusion in voluntary carbon markets. Nitrification inhibitors offer several other benefits beyond reducing N_2O emissions including increased yields and reduced offsite movement of nitrates that can impair water quality.

Animal Production

Animal production is a large component of California agriculture. The dairy and ranching industries contribute significantly to the state's animal food production supply, as do egg and poultry production. Milk and related animal food products provide a fundamental nutritional resource for local, regional, national and international populations. Dairy production leads the state as a commodity group in terms of economic value (USDA NASS, 2011). As with crop production, GHG emissions mitigation is in the best interest of animal agriculture. Climate change events such as increased temperatures are expected to cause animal stress leading to less productivity (e.g., less milk production). The primary GHG emitted from animals following anaerobic food digestion is CH_4. In general, ruminant animals such as cows and goats, and, to a lesser extent, monogastric animals such as pigs release CH_4 during digestion of grasses and feed in a process called enteric fermentation. Controlling CH_4 will be a key management strategy in the future. Methane is also produced from manure holding and storage systems such as lagoons. Research and incentives are key components to addressing GHG from animal agriculture through 2050. Recent findings show that animal agriculture production in California is highly efficient, in terms of meat and milk production per unit cow, compared to other countries and regions (Pitesky et al., 2009). Based on existing infrastructure and efficiencies, GHGs will continue to be reduced in production animal agriculture in the future using effective management strategies and new technologies. There are additional opportunities for agriculture to reduce GHGs and these are summarized by Owen et al (2013).

1. Manure management

Dairy systems generate significant amounts of CH_4 from on-site operations: primarily from manure storage lagoons. Technologies exist today for enclosing dairy lagoons to capture the CH_4 generated from anaerobic microbial decomposition of the manure in the lagoon and using the CH4 to produce energy. Use of these technologies through 2050 will contribute to reducing GHGs.

Dairy digesters

Dairy digesters (or biodigesters) are a technology that uses dairy waste to generate and capture methane-rich gas that, if cleaned of contaminants, can be burned to generate electricity or used to produce other renewable fuels. Manure biogas capture and destruction processes, such as those that produce energy, result in reduced GHG emissions from dairy systems. The Air Resources Board estimates that only eleven dairy digesters are in place in California.[1] There are a number of economic challenges limiting widespread adoption of this approach including high cost of electrical interconnection, lack of economically-viable pollution control technologies, and limited feedstock availability. These economic challenges make new projects unable to compete with other renewable resources under current rate structures. The construction of these facilities is not adequately incentivized to be widely adopted. Permitting issues were identified as a barrier, however the state has made significant efforts to improve the permitting process.

[1] http://www.arb.ca.gov/ag/manuremgmt/operating-manure-digester-site-list-1st-quarter-2013.pdf

Additionally, digesters offer non-energy benefits by providing options for increased nutrient management, reducing dairy odors, and improving overall groundwater quality. For example, biodigesters can be designed to produce an ammonia-based, stable fertilizer or fiber for animal bedding.

Organic soil amendments
Dairy manure is used as an organic plant nutrient fertilizer in some cropping systems. Ammonia (NH_4) in manure is the chemical form of nitrogen in the manure that interacts with soil microbes and is converted to nitrate (also a form of plant nutrient) and N_2O. New technologies such as nitrification inhibitors may be able to limit GHG emissions from manure but more promising methods include manure management and application practices. For instance, composting of manure before application to fields can help to stabilize the nitrogen fraction (Pratt and Castellanos, 1981), thereby reducing both N_2O emissions to the atmosphere.

Animal feed
According to a recent draft report by Moraes et al (2013), configuring the diet provided to dairy cows “has been one of the most recognized methods to mitigate methane emissions from livestock. Recent reports have been published to establish guidelines to optimize milk production through diet while at the same time, reducing enteric fermentation and methane production in the animals. Feeding practices and adding specific agents to the feed are promising long term solutions to improving GHG emissions from the animal component of agriculture.

2. Rangelands
Rangelands in California comprise approximately 30 to 50 percent of the land area in the state (Own et al., 2013). According to the California Rangeland Trust, “Rangelands are an economic, ecological and cultural resource that California cannot afford to lose. By 2040, according to an estimate of the California Department of Finance, the state's population will increase to more than 50 million people." The economic industries supported by rangelands include meat (e.g., cattle) for food production, wool (e.g., sheep) for clothing, and recreational opportunities (e.g., horses). However, increased urban population growth adds pressure on rangelands, which are often converted to housing developments. Rangelands must be maintained since they offer numerous co-benefits and opportunities to mitigate GHGs. The importance of existing grasslands (a type of rangeland) to mitigate GHGs emissions is well understood since they store one third of the world’s soil carbon (Owen et al, 2013).

A promising climate change mitigation measure from rangelands is the biological sequestration of carbon. Current research shows that specific management methods can promote long-term carbon sequestration on California range lands (Ryals and Silver, 2013; Silver et al., 2010). Other methods of using rangelands to reduce existing GHG levels in the atmosphere are provided by Owen et al (2013). Incentivizing a host of methodologies, so that rangeland managers have a list of options that in turn, provide

flexibility in land management, will allow for the use of an existing resource to mitigate GHGs on a scale that is significant.

Other Considerations

Reductions of GHGs in the future depend on several other aspects of agriculture in California. Historically, scientific research has been able to determine which mitigation measures will be the most effective in reducing GHGs given the state's diverse crops. Therefore, current and future research efforts are a critical component of ensuring agricultural sustainability and GHG mitigation in the future. Any incentive strategies must be supported by sound scientific research. Similarly, agricultural support services play an important role in outreach and education of GHG mitigation to the State's 81,500 farmers and ranchers. Maintaining and enhancing these key aspects of agriculture in California are essential to achieving further reductions of GHG emissions to meet our mid-term and long-term goals.

1. Research

Limited research funds have been available in the state for agricultural GHG research mitigation, despite the sector's social and economic value. For example, previous research on carbon sequestration potential in agriculture has largely focused on the Great Plains and states where corn is the primary crop (Follet, 2001). In general, the unique climatic conditions and diverse crops in California prevent direct implementation of management practices from other states. Therefore, comprehensive, near-term and long-term, California-specific research projects on management practices and incentive-based practices (e.g., offset protocol) must be initiated in California to address GHG mitigation measures.

Research should be focused on determining which specialty crops in California with the largest acreage can benefit from management practices such as tillage. Similar studies need to be completed for biochar and composted materials. Scientists generally agree that biochar application may have significant potential as a GHG mitigation tool, but research on the magnitude and life-cycle implications is needed. Research is required to understand the long term "permanent" benefits of soil carbon and sequestration management methods in California agricultural soils since the current scientific literature, at a national and international level, contains more uncertainty than certainty. Modeling might be useful to this research but the models must be calibrated using regional California-based agricultural conditions.

According to Suddick et al (2010), interdisciplinary research should also be considered as a fundamental priority to achieve GHG reductions in the future. Priority research areas should include topics related to agricultural economics, sociology, and the environment. Economic research areas could include the evaluation of management practice co-benefits, costs of carbon sequestration under different management practices, and crop productivity and yield responses to GHG management practices, such as conservation tillage. Sociological research areas may include determining the limitations to management practice adoption. Environmental research areas may include precision monitoring of GHGs from and to agricultural systems, modeling of

carbon sequestration and GHG measurements from agricultural crops, water savings from compost and mulch use, and model validation/verification with collected data (Suddick et al., 2010).

2. Technological aspects

The average age of a farmer in California is approximately 58 years old. A new generation of farmers will be required to support agriculture in the State. The new generation of farmers will be technologically advanced and demand tools that will help sound decision making.

At present, many technologies are being used in agriculture (e.g., remote irrigation systems). Consequently, the application of natural resources for crop production becomes highly efficient, leading to several other co-benefits in addition to GHG reductions. Sensor technologies have also been developed and implemented at the field level or are in the process of being developed. Sensors, remote mapping, and satellite technology will all play an important role in future agricultural operations and potential GHG reductions. Other technologies including infrastructure development, such as compost production, are important with a special emphasis on controlling emissions and retaining nutrients, while providing a safe food produce that reduces GHG emissions through carbon sequestration and water conservation.

3. Modeling

Modeling will play a significant role in the future of agriculture in California and GHG mitigation. It is expensive, time consuming, and resource-intensive to measure GHG emissions under all the diverse cropping systems of California. Process-based models can be used to estimate GHG changes in soil and the atmosphere for different cropping systems, soils, climates, and in some cases management practices (Suddick et al., 2010). Some local level experimental research is always needed to calibrate models to local conditions for ensuring reliability and accuracy of the results. For example, recent research, funded by CDFA, CARB, and CEC has shown that California N_2O emissions from several major crops are less than the average N_2O emissions of 1 percent, of total nitrogen applied, proposed by the IPCC. Such information is critical for accurate model projections. Currently, regional, site specific data for N_2O from nitrogen fertilizers are being gathered to support different models for agricultural systems. The models and associated management practices are discussed extensively by Guo et al. (2011). Open source models will also benefit a wide grower audience and range of expertise in the future (Camargo et al., 2013). Models can also be used to effectively calculate the carbon sequestration potential of specific cropping systems or determine which management practices can be used to effectively reduce GHG emissions into the future.

4. Agricultural support services

Agricultural support services (e.g., university extension) have declined over the years. In order to address climate change mitigation in the future with limited public resources, coalitions of land managers, regulators, scientists, and other stakeholders will need to provide support to the agricultural food production systems. This collaborative approach should be the foundation for advancing land use and management policies

that meet economic, social, and environmental objectives through consensus-driven solutions. They should also help to set regional objectives for land management and identify the relevant voluntary and/or regulatory strategies that will meet those objectives (e.g., see Solutions from the Land for specifics).

The distribution of practical management practice information to reduce GHGs, while also providing an incentive to growers (as well as other co-benefits), will be essential for the future viability of agriculture in California. For example, the benefits of incorporating cover crops into a crop rotation have been historically recognized. However, according to Mitchell et al. (2007), there are a few constraints and disadvantages which potentially affect the slow adoption of cover crops in California. They include a lack of knowledge, economic cost, incorrect choice of cover crop, and conflicting timing that interferes with the establishment of summer crops (Suddick, 2010). To effectively communicate the multiple benefits and assist growers with technical expertise required to establish cover cropping systems, a resource network of support services will need to be developed, trained, and integrated into agriculture for the future.

There is a need to increase opportunities for dialogue and education between growers, researchers, and farm advisors to effectively implement practices that have benefits to reducing GHGs from agriculture. A good example of this effort is the UC ANR Conservation Tillage Workgroup with over 540 members from the University of California systems, farmers, United States Department of Agriculture Natrual Resources Conservation Services (USDA NRCS), private sector, environmental groups and public agencies.

5. Incentives and Ecosystem Services

A promising incentive to adopt mitigation measures to reduce GHGs from agriculture comes from agricultural offsets being introduced as part of the California carbon trading market. The development of agricultural offset protocols offers a level of compliance coupled with a high degree of scientific validity. Adoption of an offset for agriculture involves numerous details of the management practices that need to be established, including research data to support the quantification and verification of GHG mitigation benefits and mechanisms to ensure permanence. Other financial incentive-based programs could prove beneficial to the adoption of specific management practices (Howitt et al., 2009; Broekhoff and Zyla, 2008). Several incentive methodologies are discussed below.

Market-based systems

New initiatives and programs that target Ecosystem Services (CDFA, 2012) have the potential to substitute for conservation payments, but are rarely structured to adequately provide returns comparable to traditional production. Producers are concerned that these markets do not meet all stakeholder demand and/or reflect consumption pressures. Without better clarity on the value of the Ecosystem Services provided, uncertainty limits the scope for landowner/operator decisions and choices to implement management practices. Land management indices, metrics, and other measurements that are understood by land owners and

operators will be important to allow the social interaction needed for market evolution. These initiatives and programs require information on the crops, management practices, and new technologies that can enhance GHG mitigation—information such as their viability in different regions, their economic costs or savings, their effect on production, and their net GHG emissions. Identification, cataloging, and providing recognition to growers for adopting existing management practices can lead to the decline in agricultural GHGs.

Regulatory Certainty
Food production in California involves numerous permits and regulatory requirements. Some policies conflict while others do not provide adequate reward for economic investment by growers and ranchers. According to the Solutions from the Land report, land owners face multiple and potentially unnecessary administrative requirements that add to the cost of managing land, regardless of the net environmental and social benefits. The report suggested that Ecosystem Service markets could help achieve some policy objectives more efficiently with sufficient incentive and reward to land owners.

Combining Practices
In many cases, multiple management activities are implemented on one parcel of land. For example, Drinkwater et al. (1998) examined three systems with different crop rotations, nitrogen fertilizer sources, and chemical application rates, with and without cover crops. Wagner-Riddle et al. (2007) compared two systems that differed in tillage, nitrogen rate, nitrogen timing, and cover crop use. Although the existing body of research is insufficient to provide estimates of net GHG potential for many combinations of practices, biogeochemical models (described in this report) can provide estimates of their GHG fluxes. The existing research that assesses combined practices is important for calibrating and testing the accuracy of these models' estimates.

Summary and Recommendations
There are significant hurdles to mitigating future GHG emissions in light of population growth, limited arable land area in California, limited water resources and on-farm economic considerations. Establishing a short and long term research component with sufficient funding, incentivizing management practices, and providing technological and education information for farmers and ranchers will sustain agriculture in the future while reducing GHGs. Several recommendations on overcoming these hurdles are listed below, including policy and financial needs. Additionally, a list of activities provided by CDFA and agriculture has been provided below. Such activities must continue so that agriculture can maintain social and economic sustainability while working to reduce GHG emissions.

Recommendations
Increase communication, cooperation, and collaboration between agencies (e.g., CDFA, CalRecycle, CARB, CEC) to promote streamlined permitting and enhance GHG mitigation opportunities from agriculture.

Establish stable funding sources to provide short and long-term research and incentive opportunities to determine and fund the cost effective and environmentally beneficial practices that reduce GHG emissions for California farmers and ranchers.

Review existing spending authorities so that GHG mitigation measures can be effectively funded, incentivized and implemented on California working lands.

Develop a plan-of-action to identify, test, fast-track, and transfer new technologies that reduce GHG emission in the agricultural sector.

Promote new technologies, management practices, and infrastructure development that mitigate GHG reductions by providing financial and regulatory incentives.

Continue the clear and consistent process for offset protocol creation and implementation with consultation from stakeholders on the practical feasibility of each protocol.

Develop a comprehensive crop specific list or recipe of GHG management practices, using existing agronomic expertise in state agencies and research Universities for voluntary use in agriculture.

Design policies to ensure farmland protection in consideration of population and urban growth will ensure agricultural sustainability and limiting urban GHG emissions.

Provide regional scale implementation and incentives for GHG mitigation measures from agriculture.

Develop regional scale management practice applications that have multiple co-benefits including GHG mitigation and carbon sequestration.

Create financial incentives for upgrading irrigation pumps in order to reduce GHG emissions and improve air quality in the State's agricultural regions.

CDFA GHG Activities

The California Department of Food and Agriculture (CDFA) has been engaged in several activities aimed at addressing GHG emissions from agriculture. These activities involve both long and short term solutions and consider GHG emissions from both animal and crop production agriculture. The activities completed to-date by CDFA involve measures related to bringing awareness to GHG mitigation from agriculture, providing education on GHG from agriculture, and promoting action, through research activities, on understanding GHG from agriculture systems.

Nitrous Oxide Research

The CDFA Fertilizer Research and Education Program (FREP) provides technical education to "users of fertilizer materials in the development and implementation of nutrient management projects that result in more agronomically sound uses of fertilizer materials and minimize the environmental impacts of fertilizer use, including…greenhouse gases resulting from fertilizer use" and fund research that "to improve nutrient management practices resulting in more agronomically sound uses of fertilizer materials and to minimize the environmental impacts of fertilizer use, including…greenhouse gases resulting from fertilizer use" (Section 14611 [b] [1] and [2]). FREP continues to fund research to understand baseline nitrous oxide (N_2O) levels from synthetic nitrogen fertilizers added at different rates to specific crops in California. Nitrous oxide is one of six green house gases identified in the Kyoto Protocol. The crops being investigated under CDFA FREP funding are corn, cotton, and tomatoes. The collected data will establish a baseline N_2O emission concentration from synthetic nitrogen applied to agricultural soils. Initial study results indicate that N_2O emissions are lower than originally thought, highly episodic, complex given the microbial nitrification and denitrification biological cycles involved, and dependent on environmental factors such as water content and temperature. Field trials are being completed by scientists at California State University, Fresno, and the University of California, Davis. Research is expected to be completed in 2014.

CalRecycle is funding research to also understand N_2O emissions from compost production and use in agriculture working lands. The research project aims to clarify GHG emissions from compost production and from compost use, including compost impacts on N_2O emissions from agricultural lands. The research is being completed by scientists at the University of California, Davis. Research is expected to be completed in Spring, 2014.

CalRecycle has engaged in several other activities and projects including a report on compost best management practices and benefits for erosion control, program environmental impact report (EIR) for anaerobic digestion facilities, collaborating with the ARB on development of low carbon fuel standards pathway for biogas production from anaerobic digestion of food and green waste, collaborating with the Department of Water resources to model water efficient landscapes practices by using compost that consequently results in conservation measures and promotes soil health, and evaluating life-cycle methodologies to quantify the GHG reductions from compost use and management.

CDFA also provides funding for GHG research as part of a Specialty Crop Block Grant Program (SCBGP). The program is designed to enhance the competitiveness of specialty crops. Implementing research on climate change is one method of addressing future concern to remain in a competitive market. The research focus called for projects that address specialty crop agriculture's contribution to adaptation to and/or mitigation of climate change. The results of the funded research projects are expected to have a direct impact on the current understanding of GHG emissions from agriculture and potential offset strategies. For instance, a 2010 project was titled, "Field Testing a

Carbon Offset and GHG Emissions Model for California Winegrape Growers to Drive Climate Protection and Innovation," is expected to provide knowledge and tools to help California winegrape growers reduce GHG emissions and increase carbon sequestration. Titles of several other funded projects include:

- Carbon dynamics of orchard floor applied chipped almond prunings as influenced by irrigation methods, soil type, cover crop management and farm practices (2010);
- California Wine Climate Protection Initiative: Calculating Scope Three Greenhouse Gas Emissions to Mitigate Climate Change, Reduce Costs, and Address International Market Demand (2011); and
- Life Cycle Assessment of Air Emissions and Greenhouse Gas Offset Potentials in Perennial Fruit and Nut Crops (2012).

This research is critical in addressing knowledge gaps in GHG emissions for California specialty crops. More information on this and other funded projects can be found at http://www.cdfa.ca.gov/Specialty_Crop_Competitiveness_Grants/.

Dairy Digester Research

Methane (CH_4) is a powerful GHG and exerts about 25 times more warming impact than CO_2 per unit mass emitted over a hundred-year time period. In the near term, methane is even more potent, with more than 70 times the climate impact of CO_2 in a 20-year period. As the importance of making substantial near-term reductions to climate-forcing agents has emerged based on scientific findings over the past decade, the need for policies to reduce methane emissions has gained attention. Dairy and poultry farm operations generate significant amounts of methane from manure handling. Anaerobic digesters (or biodigesters) use manure to generate and capture methane gas, which is in turn used for energy production. This process results in reduced greenhouse gas emissions from dairy farm operations. The widespread adoption of these technologies in California has encountered numerous challenges. In 2011, CDFA, in partnership with the U.S. Environmental Protection Agency (U.S. EPA) and the U.S. Department of Agriculture (USDA) began a series of meetings to discuss the barriers to digester implementation and create an advancement strategy. CDFA, U.S. EPA, and USDA, among others, will work with other relevant state and local agencies, as well as industry stakeholders, to address the technical, regulatory and economic barriers for a robust dairy digester sector in California.

Biofuel Crop Research

Biofuels (fuels from plants) can release less GHG compared to fossil fuels on a full life-cycle basis. CDFA, in partnership with scientists at UC Davis, and with funding from the California Energy Commission Public Interest Energy Research Program, have undertaken research to evaluate the economic, beneficial environmental factors, and costs of biofuel feedstock crops. Crops under evaluation include oilseed crops camelina, canola and meadowfoam which can be formulated into biodiesel along with grasses sweet sorghum, energy cane and sugar cane which can be transformed into ethanol. Field trials are evaluating different crop varieties, fertilization, irrigation, and planting date trials. Outcomes will focus on cropping systems for California with best management practice recommendations, estimates of direct environmental costs such

as water use, inputs levels and effects, and potential off-farm environmental consequences.

Workgroups and Panels

CDFA uses workgroups to discuss an issue with the objective of identifying practical solutions. CDFA has implemented several workgroups to address climate change mitigation and adaptation. The information is used to guide policy, address the issue directly, and identify gaps.

Climate Action Teams (CAT and AgCAT)

CDFA Secretary, Karen Ross, is a member of the Climate Action Team (CAT). CDFA staff is engaged in monthly meetings on coordinating statewide efforts to study, identify, and implement global warming emission reductions. CDFA also convenes the Agricultural Climate Action Team (AgCAT) workgroup on a need or issue basis. AgCAT is staffed by other state agency personnel working on climate change at the interface of agriculture. The initial review of this scoping document was reviewed using the inter-agency resources and feedback of AgCAT.

Fuel Quality and Standards

Transportation fuels have been identified as the largest contributor to greenhouse gas emissions making up approximately 40 percent of the total emissions. California has adopted the Low Carbon Fuel Standard (LCSF) to reduce the carbon intensity of fuels as well as the Zero Emission Vehicle (ZEV) implementation mandate to reduce dependence on petroleum-based fuels. The California Department of Food and Agriculture, Division of Measurement Standards (CDFA) is at the forefront with the California Air Resources Board (CARB) for both of these vital initiatives.

The LCFS is expected to reduce 15 million metric tons of carbon per year from California's fuels by 2020 and will ultimately lead to the development of non-petroleum fuels. By 2050, the majority of the fuels is expected to be produced from non-petroleum renewable sources. CDFA is working with innovative fuel producers to develop the fuel quality standards needed to bring these new alternative low carbon fuel technologies to market and expand the use of biodiesel, biomass-based diesel and alternatives to gasoline. CDFA's Developmental Engine Fuel Variance Program affords an opportunity for the use of these fuels while collecting data needed to develop a consensus fuel standard. CDFA is an active member of the ASTM and SAE national work groups developing fuel quality standards and laboratory analytical test methods for new fuels such as dimethyl ether and CNG. CDFA is working with CARB to develop regulatory pathways to expand use of alternative diesel fuels. CDFA is part of the State's LCFS Advisory Panel and Cal EPA's Fuel Guidance document working group.

The success of the Governor's Executive Order for ZEV implementation will depend on wide spread deployment of hydrogen fuel cell and battery electric vehicles. CDFA's development of fueling dispenser standards and method of sale requirements will give consumers an accurate and uniform purchasing experience and facilitate acceptance of ZEV vehicles. The fuel quality standards for hydrogen originally developed by CDFA

have been adopted through the consensus process and published by SAE. CDFA is leading the development of quality testing procedures, that when adopted by ASTM, will become the standard nationwide. Similarly, CDFA's hydrogen fuel dispenser and public electric charging station type evaluation and testing procedures will likely become the models that the National Conference on Weights and Measures approves for use in all states.

Agricultural Offsets
CDFA and CARB, in collaboration, have initiated and organized several stakeholder meetings with the agricultural community, in addition to regular public workshops and meetings, to discuss issues related to agricultural offsets, including quantification, monitoring, and verification. These meetings are important as an interface for CARB to update agricultural stakeholders on agricultural protocol development, discuss issues related to identifying greenhouse gas reduction measures from agriculture, strategize on best practices that can mitigate greenhouse gases from agriculture, and identify incentives for practices that support climate change policy.

Energy Commission activities include:

- In partnership with federal and State agencies, the Energy Commission has played a leading role in developing anaerobic digester systems. Specifically, the Energy Commission has funded a number of projects to develop and demonstrate advanced anaerobic digestion and power generation technologies in a variety of configurations, to explore the economics of these systems, and to measure system performance. These projects will help address the importance of reducing California's methane emissions and the possibility of doing so in a manner that is economically and environmentally attractive to California's agricultural sector. Furthermore, these projects will help reduce the air quality impacts of biogas produced from anaerobic digester systems, an important consideration in most of California's agricultural areas which are non-attainment for ozone.

- The Energy Commission is in the process of analyzing the opportunities and challenges for biogas and biomethane development in California. The Energy Commission will provide an update of the industry and recommend additional policy recommendations to the legislature and the Governor's office in the 2013 Integrated Energy Policy Report.

- The Energy Commission has proposed providing a minimum of $27 million in funding through the Electric Program Investment Charge Program (EPIC) for bioenergy technologies and deployment strategies. To meet the guidelines of the program as set forth by the CPUC, EPIC can fund research and development of pre-commercial technologies that improve the environmental performance of existing biomass/biogas technologies and commercialize technologies that show promise for meeting current environmental quality standards.

- The Energy Commission's Alternative Renewable Fuel and Vehicle Technology Program (ARFVTP) has sustainability incentives imbedded in its project evaluation criteria, which promote and incent sustainability throughout the life cycle of biofuel production.

- Market-based incentives - ARFVTP is coordinating with CARB to support the development of sustainability incentives that would increase the value of LCFS credits for biofuels production

- Coordination and technical support – ARFVTP is collaborating with CalRecycle to inform mutual policy development and to encourage CalRecyle technical support for the implementation of ARFVTP projects that are producing biogas,

- Monitoring and reporting - The Energy Commission's ARFVTP requires grant recipients to monitor and report on production activities during their project and for 6 months following the term of the agreement. If agricultural feedstocks are used in the biofuel production process, this monitoring function includes sustainability practices employed by the project's feedstock suppliers.

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Appendix C - Focus Group Working Papers

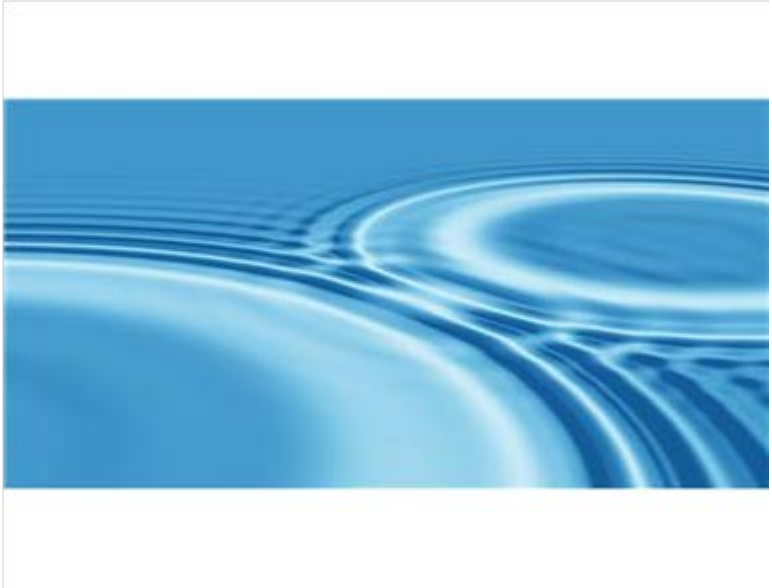
Water Sector Working Paper

In January 2014 Governor Jerry Brown released the California Water Action Plan, which was developed by the Secretaries of the California Resources Agency, California Department of Food and Agriculture, and California Environmental Protection Agency. The Water Action Plan lays the groundwork for a sustainable and resilient water and water-energy future in 2050.

During the development of the 2013 Scoping Plan Update, the water sector working group, including the California Energy Commission, State Water Resources Control Board, California Public Utilities Commission, Department of Water Resources and the Air Resources Board, discussed a 2050 vision of water and water-energy use in California that would reduce greenhouse gases 80% from 1990 levels, and what must be done now to enable the State to achieve that vision. The 2050 vision emphasized water and energy conservation, including rate structures that reward sustainable use, maintain assistance for low-income ratepayers, and give utilities the necessary operating revenue to do a good job. It identified the need for regional and local integrated water and water-energy management and governance, based on statewide standards; a portfolio of investments and incentives for multiple benefit water supply, water quality, and water-energy programs; efficient data collection; and a robust, on-going outreach and education program that results in strong support for the vision from the public and business, economic, agriculture, and environmental sectors.

The California Water Action Plan, which follows, proposes actions to take place over the next five years that will put the State on a solid path to achieve this 2050 vision to reduce greenhouse gases, and it is, therefore, the foundation for the proposed AB32 scoping recommendations in the water section of Chapter IV.

California Water Action Plan



California Natural Resources Agency

cdfa California Department of Food & Agriculture

California Environmental Protection Agency (Cal/EPA)

Among all our uncertainties, weather is one of the most basic. We can't control it. We can only live with it, and now we have to live with a very serious drought of uncertain duration.

Right now, it is imperative that we do everything possible to mitigate the effects of the drought. I have convened an Interagency Drought Task Force and declared a State of Emergency. We need everyone in every part of the state to conserve water. We need regulators to rebalance water rules and enable voluntary transfers of water and we must prepare for forest fires. As the State Water Action Plan lays out, water recycling, expanded storage and serious groundwater management must all be part of the mix. So too must be investments in safe drinking water, particularly in disadvantaged communities. We also need wetlands and watershed restoration and further progress on the Bay Delta Conservation Plan.

It is a tall order.

But it is what we must do to get through this drought and prepare for the next.

Edmund G. Brown Jr.
State of the State Speech, January 22, 2014

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California Water Action Plan: Actions for Reliability, Restoration and Resilience

Introduction

California has seen many flood events, including the most recent flood of 1995 when 48 of 58 counties declared a state of emergency. After two years of dry weather and shrinking reservoir supplies, we are reminded once again that nothing focuses Californians' attention on our limited water resources like drought.

There is broad agreement that the state's water management system is currently unable to satisfactorily meet both ecological and human needs, too exposed to wet and dry climate cycles and natural disasters, and inadequate to handle the additional pressures of future population growth and climate change. Solutions are complex and expensive, and they require the cooperation and sustained commitment of all Californians working together. To be sustainable, solutions must strike a balance between the need to provide for public health and safety (*e.g.*, safe drinking water, clean rivers and beaches, flood protection), protect the environment, and support a stable California economy. This action plan lays out our challenges, our goals and decisive actions needed now to put California's water resources on a safer, more sustainable path. While this plan commits the state to moving forward, it also serves to recognize that state government cannot do this alone. Collaboration between federal, state, local and tribal governments, in coordination with our partners in a wide range of industry, government and nongovernmental organizations is not only important—it is essential. The input and contributions received from all of these partners throughout the drafting of this action plan have resulted in a comprehensive and inclusive plan.

Challenges for Managing California's Water Resources

Water has always been a scarce resource in California. Most of the precipitation falls on the west-facing slopes of Northern California mountain ranges, yet most of the population and irrigated farmland is located in the drier southern half of the state. Precipitation is highly variable year-to-year, but the long warm summers are always dry. In the mid-20th century, state, federal and local agencies vastly expanded the state's system of reservoirs, canals, pumps and pipelines to store water and deliver it to agricultural and urban users in dry areas. Also, in the late 20th century, significant investments were made in the state's flood protection system, including levees and bypasses. These changes to the physical infrastructure have resulted in unintended consequences to the natural world. In general, there is broad consensus about our challenges.

> ***Uncertain water supplies –*** Reductions in water from major watersheds like the Colorado River watershed and the Sacramento-San Joaquin Delta (Delta) watershed—due to hydrologic and declining environmental conditions—have made these water supplies less reliable. Moreover, climate change impacts to these sources and the Cascade and Sierra headwaters will further strain supply reliability throughout the state. These sources are foundational supplies around which communities develop and manage local resources through strategies such as water use efficiency, recycled water, and groundwater recharge. The unreliable nature of these supplies threatens local, regional and statewide economies. **Collectively, the actions in this plan will contribute to more reliable water supplies**.

Water scarcity/drought – California's hydrology has always included extended dry periods. Much of California's water system was originally designed to withstand a seven-year dry period without severe damage to the economy and environment. Today some regions and many communities struggle to maintain adequate water supplies after only a year or two of dry conditions. Climate change makes this situation even more challenging. Less outflow of water coming from the Cascades and Sierras during periods of drought increases seawater intrusion into the Delta. Improving our ability to manage scarce water supplies and over-stressed groundwater basins and better coordination of major reservoir operations is essential to economic and environmental sustainability. Taking action to address drought is especially urgent for agriculture where crops wither without water, and the world's growing population and food demand create food security concerns. **This action plan includes both immediate steps for 2014 as well as actions that will better prepare California for future droughts.**

Declining groundwater supplies – Groundwater accounts for more than one-third of the water used by cities and farms – much more in dry years, when other sources are cut back. Some of California's groundwater basins are sustainably managed, but unfortunately, many are not. Inconsistent and inadequate tools, resources and authorities make managing groundwater difficult in California and impede our ability to address problems such as overdraft, seawater intrusion, land subsidence, and water quality degradation. Pumping more than is recharged lowers groundwater levels – which makes extracting water more expensive and energy intensive. Under certain conditions, excessive groundwater pumping could mobilize toxins that impair water quality and cause irreversible land subsidence which damages infrastructure and diminishes the capacity of aquifers to store water for the future. When properly managed, groundwater resources will help protect communities, farms and the environment against the impacts of prolonged dry periods and climate change. **The strategies identified in this action plan will move California toward more sustainable management of our groundwater resources.**

Poor water quality – It is a fact that millions of Californians rely, at least in part, on contaminated groundwater for their drinking water. While most water purveyors blend or treat water to meet public health standards, many disadvantaged communities cannot afford to do so. In addition, domestic wells are drying up in many areas. All Californians have a right to safe, clean, affordable and accessible water adequate for human consumption, cooking and sanitary purposes. Safe water is necessary for public health and community prosperity. **The methods set forth in this action plan will improve the organization of our water quality programs and create new tools to help ensure that every Californian has access to safe water.**

Declining native fish species and loss of wildlife habitat – California's once robust native fish populations are at or near historic lows. Federal and state fish agencies now list many species of salmon and other fish as endangered and threatened. Wildlife habitat is also being lost at a rapid pace. Climate change further threatens the state's natural biodiversity. Many do not understand that our fish and wildlife are part of the complex system that provides and protects California's water resources. Tourism and fishing which provide economic benefits to local communities and to the state are also reliant on healthy ecosystems. Declining species and lost habitat disrupt the cultural, spiritual and ecological practices of California's Native American tribes. Simply put, California's diverse and unique ecosystems are irreplaceable and their loss threatens the sustainability of all of California's communities. **The objectives in this action plan include aggressive ecosystem restoration and other steps that will restore fish populations and benefit wildlife.**

Floods – Over 7 million Californians live in a floodplain. Historically, flooding has occurred in all regions of the state. Our state's capital, Sacramento, has one of the lowest levels of flood protection of any major city in the nation. Climate change will only exacerbate this problem. More precipitation will fall as rain rather than snow, snowmelt will occur earlier, and there will be more extreme weather events. **This action plan will serve to coordinate and streamline flood control efforts and result in multi-benefit flood projects, helping to mitigate the significant investments needed to improve flood protection for existing communities and infrastructure.**

Supply disruptions – Many parts of California's water system are vulnerable to earthquakes and flooding, particularly the Delta, which serves as the conveyance hub for a substantial percentage of all water supplies in the Bay Area, the San Joaquin Valley, and Southern California. A large earthquake along any of five major faults or a major storm-induced levee failure could render this water supply unreachable or unusable for urban and agricultural needs for months. **The combined benefits of many of the actions in this plan will better prepare us to manage through potential disruptions in the system.**

Population growth and climate change further increase the severity of these risks – The state's population is projected to grow from 38 million to 50 million by 2049.[1] The effects of climate change are already being felt and will worsen. The Sierra snowpack is decreasing, reducing natural water storage and altering winter and spring runoff patterns. This is most likely the result of higher temperatures and may also be related to air pollution that deposits fine particulate on the surface of snow, changing its reflectivity and causing it to absorb more heat and melt faster. Higher river and ocean water temperatures will make it harder to maintain adequate habitat for native fish species. Higher ocean temperatures will alter the already changing weather patterns. Sea level rise threatens coastal communities and islands in the Delta. Sea level rise also amplifies the risk that the pumps that supply cities and farms with Delta water will be inundated with seawater in a large earthquake or storms that breach levees. **The strategies identified in this action plan will help protect our resources from more frequent and more severe dry periods which threaten the health of our natural systems and our ability to meet our diverse water supply and water quality needs**.

Goals: Reliability, Restoration and Resilience

The California Water Action Plan has been developed to meet three broad objectives: more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades. Over the next five years, the actions discussed below will move California toward more sustainable water management by providing a more reliable water supply for our farms and communities, restoring important wildlife habitat and species, and helping the state's water systems and environment become more resilient.

[1] http://www.dof.ca.gov/research/demographic/reports/projections/view.php California's population will cross the 50 million mark in 2049 and grow to nearly 52.7 million by 2060.

Working Together and Continued Collaboration is Essential

Despite the many challenges for water management in California, there is good progress to report. There are thousands of important projects that are being planned or implemented by all levels of government as well as by conservationists, tribes, farmers, water agencies and others. State, regional and local agencies have increasingly been pursuing a strategy of making regions more self-reliant by reducing water demand and by developing new or underused water resources locally. In the future, most new water will come from a combination of improved conservation and water use efficiency, conjunctive water management (i.e., coordinated management of surface and groundwater), recycled water, drinking water treatment, groundwater remediation, and brackish and seawater desalination. There is increased focus on projects with multiple benefits, such as stormwater capture and floodplain reconnection, that can help simultaneously improve the environment, flood management and water supplies. These diversified regional water portfolios will relieve pressure on foundational supplies and make communities more resilient against drought, flood, population growth and climate change.

This Water Action Plan does not replace these local efforts. It complements and leverages them. Collaboration is essential. Successful implementation of this plan will require increased collaboration between state, federal and local governments, regional agencies, tribal governments, and the public and the private sectors. The Legislature is also a key partner.

Water has shaped California's past, its present, and will help define its future. Water has always been among the state's most contentious issues. California is at its best when people come together in the face of adversity to solve difficult problems. Only by working together can we improve and sustain the state's water future for generations to come.

Actions

1. Make conservation a California way of life;
2. Increase regional self-reliance and integrated water management across all levels of government;
3. Achieve the co-equal goals for the Delta;
4. Protect and restore important ecosystems;
5. Manage and prepare for dry periods;
6. Expand water storage capacity and improve groundwater management;
7. Provide safe water for all communities;
8. Increase flood protection;
9. Increase operational and regulatory efficiency;
10. Identify sustainable and integrated financing opportunities.

Together, these actions address the most pressing water issues that California faces while laying the groundwork for a sustainable and resilient future and are critical to moving the state forward now. They reflect an integration of new ideas with the ongoing important work that the state and federal government, local agencies, and others are already engaged in and require coordination and collaboration across levels of government. They will not address all of our challenges. Some of these actions are new proposals. Some are currently being planned and should be completed more rapidly, implemented in a better way, or on a larger scale. Success will require the cooperation of many partners; the state's role is to lead, help others, and remove barriers to action.

1. MAKE CONSERVATION A CALIFORNIA WAY OF LIFE

Conservation must become a way of life for everyone in California. Much has changed in the past half century, and our technology, values and awareness of how we use water have helped to integrate conservation into our daily lives. There is more that can be done and all Californians must embrace this effort. In 2009, the state adopted the Water Conservation Act through the passage of Senate Bill X7 7 requiring that we achieve a 20 percent reduction in urban per capita water use by December 31, 2020, promoting expanded development of sustainable water supplies at the regional level, and requiring agricultural water management plans and efficient water management practices for agricultural water suppliers. Conservation and efficiency are also keys to reducing the energy needed to pump, transport, treat and deliver water – an important action included in the state's Climate Change Scoping Plan for reducing greenhouse gas emissions. We must continue to build on our existing efforts to conserve water and promote the innovation of new systems for increased water conservation.

- **Expand Agricultural and Urban Water Conservation and Efficiency to Exceed SBX7 7 Targets**
  The administration will expand existing programs to provide technical assistance, shared data and information, and incentives to urban and agricultural local and regional water agencies, as well as local governmental agencies, to promote agricultural and urban water conservation in excess of the amounts envisioned by SBX7 7. We will work collaboratively with stakeholders to identify and remove impediments to achieving statewide conservation targets, recycling and stormwater goals; to evaluate and update targets for additional water use efficiency, including consideration of expanding the 20 percent by 2020 targets by holding total urban water consumption at 2000 levels until 2030, achieving even greater per capita reductions in water use. The administration will also work with local and regional entities to develop performance measures to evaluate agricultural water management.

- **Provide Funding for Conservation and Efficiency**
  The administration will work with the Legislature to expand funding for urban and agricultural water use efficiency research, and the development and implementation of efficiency standards through existing and new programs that save water and the energy associated with water use. Conservation programs must include numeric targets and be designed to achieve the state-developed targets and performance measures.

- **Increase Water Sector Energy Efficiency and Greenhouse Gas Reduction Capacity**
  The administration will continue supporting the collection of regional data and development of efficiency standards that save water and energy associated with water use and will provide guidance on conservation rates and sustainable financing that achieve water and energy savings. The administration will also continue to collaborate with water and wastewater agencies and energy utilities to educate consumers on the water-energy nexus. The administration will work with the Legislature to eliminate barriers to co-funding projects with water and energy benefits and expand and prioritize funding and technical support for water and wastewater agencies that achieve energy efficiency co-benefits and greenhouse gas reductions.

- **Promote Local Urban Conservation Ordinances and Programs**
  Local agencies are increasingly conserving water by prohibiting certain types of wasteful water use. Examples include: prohibiting watering hard surfaces such as sidewalks, walkways, driveways or parking areas; prohibiting outdoor watering during periods of rain; and not serving water to customers in restaurants unless specifically requested. Local agencies are also pioneering incentive programs, for example, converting lawns to drought tolerant landscapes—and programs to capture rainwater.

2. INCREASE REGIONAL SELF-RELIANCE AND INTEGRATED WATER MANAGEMENT ACROSS ALL LEVELS OF GOVERNMENT

While California has vast infrastructure to store and deliver water miles from its origin, the majority of infrastructure management and investment resides at the local and regional levels. Sometimes that management is done by agencies responsible for multiple functions such as flood management, water supply and water quality. Other times, individual agencies handle those functions separately. Over the past decade, the state has provided technical and financial assistance to regions to incentivize inter-agency/stakeholder cooperation in planning and implementing multi-objective actions that provide both regional and statewide benefits to water resources management and protection. Called "integrated water management," this approach balances the objectives of improving public safety, fostering environmental stewardship, and supporting economic stability. Developing local supplies can also save energy by reducing the distance that water must be transported. State grants are provided to both incentivize regional integration and leverage local financial investment.

Ensuring water security at the local level includes efforts to conserve and use water more efficiently, to protect or create habitat for local species, to recycle water for reuse, to capture and treat stormwater for reuse, and to remove salts and contaminants from brackish or contaminated water or from seawater. But, mostly it requires integrating disparate or individual government efforts into one combined regional commitment where the sum becomes greater than any single piece.

- **Support and Expand Funding for Integrated Water Management Planning and Projects**
  The administration will work with the Legislature to enhance the Integrated Water Management Planning program. Providing funding for regionally-driven, multi-benefit projects that prioritize protection of public health is critical. The administration will target funding to local regional projects that increase regional self-reliance and result in integrated, multi-benefit solutions for ensuring sustainable water resources.

- **Update Land Use Planning Guidelines**
  The Governor's Office of Planning and Research (OPR) will engage local land use authorities, California Native American tribes, and water agencies to amend the general plan guidelines to promote greater consistency between local land use plans and decisions and integrated regional water management plans and decisions. OPR will also work with the Legislature to determine whether water should be a mandatory feature of the general plan guidelines.

- **Legislation for Local and Regional Self Reliance**
  The administration will work with the Legislature to encourage local governments to adopt or amend local ordinances that enhance local and regional water supply reliability and conservation, such as ordinances that establish minimum requirements for infiltration or injection of water into the groundwater table, detection and prevention of utility system leaks, landscaping measures, and indoor/outdoor water use efficiency standards.

- **Provide Assistance to Disadvantaged Communities**
  The administration will provide technical assistance, tools, and allocate dedicated funds for grant administration, project development, and stakeholder collaboration to under-represented and economically-disadvantaged communities to promote greater participation and success in regional grant programs.

- **Demonstrate State Leadership**
  All state agencies should take a leadership role in designing new and retrofitted state owned and leased facilities to increase water efficiency, use recycled water, and incorporate stormwater runoff capture and low-impact development strategies.

- **Encourage State Focus on Projects with Multiple Benefits**
  The administration will direct agencies and departments to evaluate existing programs and propose modifications to incentivize and co-fund multi-benefit projects that promote integrated water management, such as stormwater permits that emphasize stormwater capture and infiltration, which provide both flood protection and groundwater recharge benefits, and agricultural groundwater recharge projects that emphasize water quality and conjunctive use. The commitment to emphasize multiple benefit projects will be applied to most of the actions in this plan.

- **Increase the Use of Recycled Water**
  California needs more high quality water, and recycling is one way of getting there. The state will adopt uniform water recycling criteria for indirect potable reuse of recycled water for groundwater recharge. Technical and financial assistance will be provided to projects that meet these criteria. The administration will also develop criteria for direct potable reuse and will seek to consolidate the state's recycling programs in the State Water Resources Control Board to promote program efficiencies.

- **Streamline Permitting for Local Water Reuse or Enhancement Projects**
  The administration will review and propose measures to streamline permitting for local projects that make better use of local water supplies such as recycling, stormwater capture, and desalination of brackish and seawater as well as projects that provide multiple benefits, such as enhancing local water supplies while improving wildlife habitat.

3. ACHIEVE THE CO-EQUAL GOALS FOR THE DELTA

The Delta is California's major collection point for water, serving two-thirds of our state's population and providing irrigation water for millions of acres of farmland. The region supports farming, wetland and riparian habitats, as well as numerous fish and wildlife species. In recent years, important fish populations have declined dramatically, leading to historic restrictions on water supply deliveries. Moreover, the current system relies on water flowing through a network of fragile levees from the northern part of the Delta to the pumps in the south, where two out of three fish trapped near the pumps die. These levees were not designed to resist a significant seismic event, the probability of which is greater than 60 percent over the next 50 years. They are also vulnerable to major floods and rising sea levels, all of which puts unacceptable risk on the people who live in the Delta as well as the water supply for 25 million people and 3 million acres of farmland. Plans are underway to address these problems. The issues are contentious and have been for decades. But, the status quo in the Delta is unacceptable and it would be irresponsible to wait for further degradation or a natural disaster before taking action.

The Delta Stewardship Council was created in legislation to achieve the state-mandated co-equal goals of providing a more reliable water supply for California and to protect, restore and enhance the Delta ecosystem. Those two goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource and agricultural values of the Delta as an evolving place. The council recently adopted its Delta Plan and will establish a high-level interagency coordinating body to commence implementation of a suite of actions designed to achieve the co-equal goals. The Implementation Committee can play a strong role in moving forward on the actions included in this plan, which include and build on many of the priorities included in the council's Delta Plan.

- **Begin Implementation of the Delta Plan**
  The administration directs all of its relevant agencies to fully participate in the Implementation Committee established by the Delta Stewardship Council and to work with the Delta Science Program, the Interagency Ecological Program, and others to implement the Delta Science Plan to enhance water and natural resource policy and management decisions.

- **Complete Comprehensive Plans to Recover Populations of Threatened and Endangered Species in the Delta and Improve Water Supply Reliability for Users of Delta Water**
  State and federal agencies will complete planning for a comprehensive conservation strategy aimed at protecting dozens of species of fish and wildlife in the Delta, while permitting the reliable operation of California's two biggest water delivery projects. The Bay Delta Conservation Plan (BDCP) will help secure California's water supply by building new water delivery infrastructure and operating the system to improve the ecological health of the Delta. It will also restore or protect approximately 145,000 acres of habitat to address the Delta's environmental challenges. The BDCP is made up of specific actions, called conservation measures, to improve the Delta ecosystem. It includes 22 conservation measures aimed at improving water operations, protecting water supplies and water quality, and restoring the Delta ecosystem within a stable regulatory framework. The project will be guided by 214 specific biological goals and objectives, improved science, and an adaptive management approach for operating the water conveyance facilities and implementing other conservation measures including habitat restoration and programs to address other stressors. As the Delta ecosystem improves in response to the implementation of the conservation measures, water operations would become more reliable, offering secure water supplies for 25 million Californians, an agricultural industry that feeds millions, and a thriving economy.

State and federal agencies will complete the state and federal environmental review documents; seek approval of the BDCP by the state and federal fishery agencies; secure all permits required to implement the BDCP; finalize a financing plan; complete the design of BDCP facilities; and begin implementation of all conservation measures and mitigation measures, including construction of water conveyance improvements. Once the BDCP is permitted, it will become part of the Delta Plan.

- **Restore Delta Aquatic and Intertidal Habitat**
  In coordination with restoration proposed by the BDCP, a specific set of projects or acreage for restoration will be identified in the six priority areas listed in the Delta Plan: (1) Yolo Bypass; (2) Cache Slough Complex; (3) the confluence of the Cosumnes and Mokelumne rivers; (4) the lower San Joaquin River floodplain; (5) Suisun Marsh; and, (6) western Delta/eastern Contra Costa County. The Department of Water Resources, in consultation and coordination with the Department of Fish and Wildlife, the Delta Science Program, and the Delta Plan Implementation Committee will initiate projects to restore 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh. These agencies will also coordinate with federal agency partners to ensure consistency with federal restoration efforts or requirements.

- **Implement Near-Term Delta Improvement Projects**
  In coordination with restoration proposed in BDCP, the Department of Water Resources will initiate a project to remove fish passage barriers within the Yolo Bypass and modify the Fremont Weir to increase the amount and quality of fish rearing habitat by improving access to seasonal floodplain habitat.

- **Maintain Important Infrastructure**
  The Department of Water Resources will continue implementation of the Delta Levees Subventions, Delta Special Projects, and Floodway Corridor Programs to provide financial assistance to local agencies for repair and improvement of levees and other multipurpose projects in the Delta.

- **Bay Delta Water Quality Control Plan**
  The State Water Resources Control Board will complete its update of the Water Quality Control Plan for the Delta and its upstream watersheds. The plan establishes both regulatory requirements and recommended actions. The State Water Resources Control Board's action will balance competing uses of water including, municipal and agricultural supply, hydropower, fishery protection, recreation, and other uses.

4. PROTECT AND RESTORE IMPORTANT ECOSYSTEMS

Streams and rivers once ran freely from high in the mountains to downstream reaches, meandering naturally through lowland and floodplain habitats, connecting with coastal estuaries and the Pacific Ocean. The variability of natural water flows in this complex system created vibrant and resilient habitat for many species and functioned to store water, recharge groundwater, naturally purify water, and moderate flooding. Over 80 percent of the Central Valley's historical floodplain, riparian and seasonal wetland habitats have been lost in the last 150 years. This loss affects the physical and ecological processes of the Central Valley and beyond, contributes to the decline of salmon and steelhead, restricts habitat for waterfowl and other species, and impacts water supply, flood protection, and sediment control. In watersheds around the state, fish and wildlife no longer have access to habitat or enough cold, clean water at key times of the year. In response to these losses and ecological challenges, as well as in anticipation of the effects of climate change on the timing, volume and temperature of water flows, activities to protect and restore the resiliency of our ecosystems will help support fish and wildlife populations, improve water quality, and restore natural system functions. This effort will increase collaboration and transparency and ensure that management decisions are supported by the best available science.

- **Restore Key Mountain Meadow Habitat**
  The Department of Fish and Wildlife, in coordination with other state resource agencies, will restore 10,000 acres of mountain meadow habitat in strategic locations in the Sierra Nevada and Cascade mountain ranges, which can increase groundwater storage and provide habitat for more than 100 native species, many of which are at risk as threatened or endangered. The department will also coordinate with federal agencies, local governments, conservation organizations, tribes, and others as necessary on this action to maximize efforts and avoid duplication.

- **Manage Headwaters for Multiple Benefits**
  Watersheds in the Cascades, Sierra Nevada and other forested areas of the state are the places of origin for more than two-thirds of the state's developed water supply. Water originating in the Cascades and Sierra Nevada supplies all or part of the need for 23 million Californians and millions of acres of agricultural land. Up to one-half of the fresh water flowing into the Delta begins as snow and rain in these watersheds.

Many of these crucial watersheds are in poor health due to a number of factors. A changing climate of warmer temperatures will exacerbate the diseases and pests that create additional fire risk and, with more precipitation falling as rain instead of snow, create significant operational challenges for our reservoirs. Large, intense fires such as the recent Rim Fire will produce tons of sediment, much of which will end up in reservoirs, significantly reducing storage capacity and impacting water quality.

In order to reduce the significant risks posed to the water resources flowing from the Cascade, Sierra and other watersheds in the state, there is a critical need to address the following:

- Restore forest health through ecologically sound forest management. Overgrown forests not only pose a risk of catastrophic fire, but can significantly reduce water yield.

- Protect and restore degraded stream and meadow ecosystems to assist in natural water management and improved habitat. Meadows provide a natural storage opportunity, critically important with a changing climate, while properly functioning stream systems reduce downstream sedimentation and enhance critical aquatic habitat.

- Support and expand funding for protecting strategically important lands within watersheds to ensure that conversion of these lands does not have a negative impact on our water resources. By working with willing landowners, protection of key lands from conversion will result in a healthier watershed by reducing polluted runoff and maintaining a properly functioning ecosystem.

- **Bring Back Salmon to the San Joaquin River**
  The Department of Fish and Wildlife and the Department of Water Resources will lead the state's effort to achieve the goals of restoring flows to the San Joaquin River from Friant Dam to the confluence of the Merced River, and bring back a naturally-reproducing, self-sustaining Chinook salmon fishery while reducing or avoiding adverse water supply impacts. Chinook will be reintroduced pursuant to the San Joaquin River Restoration Program, and the Department of Fish and Wildlife will complete construction of the conservation hatchery and research facility. The Department of Water Resources will perform activities that support the implementation of channel and structural improvements that result in restoring fish and flows. The administration will work with the Legislature and others to secure further funding as necessary to achieve these activities and the restoration goal.

- **Protect Key Habitat of the Salton Sea Through Local Partnership**
  The Natural Resources Agency, in partnership with the Salton Sea Authority, will coordinate state, local and federal restoration efforts and work with local stakeholders to develop a shared vision for the future of the Salton Sea. The Salton Sea is one of the most important migratory bird flyways in North America and is immediately threatened with reduced inflows and increasing salinity. The Department of Fish and Wildlife and the Department of Water Resources will begin immediately to implement the first phase of this effort with the construction of 600 acres of near shore aquatic habitat to provide feeding, nesting and breeding habitat for birds. This project is permitted to increase to 3,600 acres and could be scaled even greater with additional resources. Concurrently, the Natural Resources Agency and the Salton Sea Authority are developing a roadmap for the Salton Sea that will evaluate additional restoration projects and identify economic development opportunities through renewable energy development.

- **Restore Coastal Watersheds**
  The Department of Fish and Wildlife in coordination with other state resource agencies and other stakeholders, as appropriate, will develop at least 10 off-channel storage projects, modernize at least 50 stream crossings, and also implement at least 10 large-scale habitat projects along the California coast in strategic coastal estuaries to restore ecological health and natural system connectivity, which will benefit local water systems and help defend against sea level rise.

- **Continue Restoration Efforts in the Lake Tahoe Basin**
  California, in partnership with the state of Nevada and the federal government, will continue its efforts to protect the beautiful and unique waters of Lake Tahoe. The Natural Resources Agency will maintain its role in leading the coordination of the state departments, the boards, and the conservancy involved in the bi-state efforts underway to restore, preserve and enhance the Lake Tahoe region. California's restoration efforts at Lake Tahoe include, among other things, support of the Tahoe Regional Planning Agency's implementation of its Regional Plan Update, putting into place the science provisions contained in the recently enacted SB 630, and support for projects contained in the region's Environmental Improvement Program.

- **Continue Restoration Efforts in the Klamath Basin**
  The Department of Fish and Wildlife and the Natural Resources Agency will continue to work with diverse stakeholders to implement the Klamath Basin restoration and settlement agreements. Those agreements include measures to improve water quality in the Klamath River, restore anadromous fish runs, including Chinook and Coho salmon, and improve water reliability for agricultural and other uses by providing a drought planning mechanism for low water years. The administration will work with Congress to secure the necessary federal authorizations for the agreements and secure the necessary funding for removal of four hydroelectric dams on the Klamath River and funding for the necessary basin restoration.

- **Water for Wetlands and Waterfowl**
  The Department of Fish and Wildlife in coordination with other state resource agencies will develop and implement a water acquisition, management, and water use efficiency strategy in coordination with the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, Central Valley Project Improvement Act refuge water program, and Central Valley Joint Venture to secure reliable and affordable water for managed wetlands statewide. The administration will work with the Legislature, and others, to secure funding to acquire water and to replace or repair the most in need conveyances for delivering water for wetlands.

- **Eliminate Barriers to Fish Migration**
  This action has three parts. First, in coordination with the Central Valley Project Improvement Act Anadromous Fish Screen Program, the Department of Fish and Wildlife will create and publish a Priority Unscreened Diversion List in the Central Valley area. Second, the administration will work with the Legislature and others to secure funding to install or repair the top 10 unscreened diversions on the priority list described above. Third, in smaller watersheds around the state, the Department of Fish and Wildlife will complete a comprehensive analysis, working with other state and federal agencies, to optimize barrier removal projects and river and stream priorities, and then complete culvert and bridge improvement and small dam removal projects to provide anadromous fish species access to historic spawning and rearing habitat.

- **Assess Fish Passage at Large Dams**
  The Department of Fish and Wildlife, in coordination with state and federal resource agencies, will develop an evaluation and feasibility process for addressing fish passage at California's rim dams and develop rim dam solution plans for the most feasible locations. Rim dams are the large dams at the base of most major river systems in California. They are too integral to California's water infrastructure to consider removing, but, where feasible, passage around the rim dams may be necessary to recover salmon and steelhead, because 95 percent of the historical habitat for these fish is above the dams. This action will require coordination with local water agencies and dam owners and operators, as well as other stakeholders.

- **Enhance Water Flows in Stream Systems Statewide**
  The State Water Resources Control Board and the Department of Fish and Wildlife will implement a suite of individual and coordinated administrative efforts to enhance flows statewide in at least five stream systems that support critical habitat for anadromous fish. These actions include developing defensible, cost-effective, and time-sensitive approaches to establish instream flows using sound science and a transparent public process. When developing and implementing this action, the State Water Resources Control Board and the Department of Fish and Wildlife will consider their public trust responsibility and existing statutory authorities such as maintaining fish in good condition.

- **Achieve Ecological Goals through Integrated Regulatory and Voluntary Efforts**
  The San Francisco Bay and Sacramento-San Joaquin River Delta are some of the most studied ecosystems in the nation. Similarly, there are many scientific and management plans about the decline of salmon and steelhead in California. A fundamental ecological principle is that aquatic species and estuarine ecosystems need enough cold, clean water at the right times of year to ensure species abundance and health and ecological function. Integration across and between all voluntary and regulatory efforts may be necessary to truly achieve basic ecological outcomes.

As a goal, the state must continue to consider how to provide water flows necessary to meet current state policy, such as significantly increasing salmon, steelhead and trout populations while also supporting viable, self-sustaining populations of a broad range of other native aquatic species, and ensure sustainable river and estuary habitat conditions for a healthy, functional Bay Delta ecosystem. The administration, with the involvement of stakeholders, will build on the work in tributaries to the Sacramento and San Joaquin rivers, analyze the many voluntary and regulatory proceedings underway related to flow criteria, and make recommendations on how to achieve the salmon and steelhead and ecological flow needs for the state's natural resources through an integrated, multi-pronged approach.

5. MANAGE AND PREPARE FOR DRY PERIODS

Water supply reliability is critical to maintaining California's economy. Temporary shortages caused today by extended, severe dry periods will become more frequent with climate change. Effective management of water resources through all hydrologic conditions will reduce impacts of shortages and lessen costs of state response actions. Many actions will help to secure more reliable water supplies and consequently improve drought preparedness. The actions identified below are specifically designed to address drought conditions and make California's water system more resilient.

- **Revise Operations to Respond to Extreme Conditions**
  State natural resources and water quality agencies, in collaboration with their federal counterparts, will implement a series of administrative solutions through a transparent process to make water delivery decisions and propose options to address water quality and supply objectives in extreme conditions. Through these state agencies, the administration will exercise the maximum administrative discretion and flexibility possible to address the current dry conditions now and into 2014. Especially in drought conditions, adaptive management can have substantial fishery, water quality, and water supply benefits. The identification of such opportunities requires continued improved water forecasting and prompt inter and intra agency coordination and communication. It also requires an effective coordination mechanism involving the Department of Water Resources, the U.S. Bureau of Reclamation, the State Water Project and the Central Valley Project contractors, the state and federal fishery agencies, and the State Water Resources Control Board, at a minimum.

- **Streamline Water Transfers**
  State agencies, in collaboration with their federal counterparts, will take all feasible steps to streamline water transfer processes to address both extreme situations and normal system operations. These include refining the schedule for the water transfer process, while considering cumulative, ground and surface water and third party impacts; and ensuring that transfers are based on measured water use. The administration will also improve outreach in support of local water transfer programs.

6. EXPAND WATER STORAGE CAPACITY AND IMPROVE GROUNDWATER MANAGEMENT

On average, the state receives about 200 million acre-feet of water per year in the form of rain and snow. In reality, the average rarely occurs, as California has the most variable weather conditions in the nation and climate change may increase the variability. Storage, whether surface storage or groundwater storage, can hold water when it flows heavily for use at times when it does not and create greater flexibility in the system. Above ground (surface storage) can be in the form of large on-stream dams and reservoirs, or smaller on stream and off stream reservoirs. Groundwater storage consists of replenishing groundwater basins either directly through injection, or by allowing water to percolate into the ground naturally or from constructed spreading basins and some forms of stormwater capture. Surface storage can be operated in conjunction with groundwater storage to increase opportunities for groundwater recharge during high flow periods and thereby increase comprehensive water management benefits. Constructing surface storage can be challenging for environmental or financial reasons. Developing groundwater storage can be challenging because many basins are contaminated and this method of storage also requires an ability to measure and withdraw water.

The bottom line is that we need to expand our state's storage capacity, whether surface or groundwater, whether big or small. Today, we need more storage to deal with the effects of drought and climate change on water supplies for both human and ecosystem needs. Climate change will bring more frequent drought conditions and could reduce by half our largest natural storage system—the Sierra snowpack—as more precipitation falls as rain rather than snow, and as snow melts earlier and more rapidly. Moreover, we must better manage our groundwater basins to reverse alarming declines in groundwater levels. Continued declines in groundwater levels could lead to irreversible land subsidence, poor water quality, reduced surface flows, ecosystem impacts, and the permanent loss of capacity to store water as groundwater.

Demand for water goes well beyond water supply and flood management, the traditional purposes for which California's major reservoirs were built. Today, water storage is also needed to help provide widespread public and environmental benefits, such as seasonal fish flows, improved water quality, water cool enough to sustain salmon, and increased flexibility to meet multiple demands, especially in increasingly dry years. The financing of additional water storage in California must reflect not just specific local benefits, but also these broader public benefits.

- **Provide Essential Data to Enable Sustainable Groundwater Management**
  The administration will expand and fund the California Statewide Groundwater Elevation Monitoring Program, which provides essential data to characterize the state's groundwater basins, including identifying basins in decline. In coordination with federal, tribal, local and regional agencies, state agencies will conduct groundwater basin assessments and develop assessment reports.

- **Support Funding Partnerships for Storage Projects**
  The administration will work with the Legislature to make funding available to share in the cost of storage projects if funding partners step forward. The state will facilitate among willing local partners and stakeholders the development of financeable, multi-benefit storage projects, including working with local

partners to complete feasibility studies. For example, the Sites Project Joint Powers Agreement, formed by a group of local government entities in the Sacramento Valley, is a potential emerging partnership that can help federal and state government determine the viability of a proposed off stream storage project – Sites Reservoir.

- **Update Bulletin 118, California's Groundwater Plan**
  The Department of Water Resources, in consultation with the U.S. Bureau of Reclamation, U.S. Geological Survey, the State Water Resources Control Board, and other agencies and stakeholders will update Bulletin 118 using field data, California Statewide Groundwater Elevation Monitoring, groundwater agency reports, satellite imagery, and other best available science, so that this information can be included in the next California Water Plan Update and be available for inclusion in future water management and land use plans. The Bulletin 118 update should include a systematic evaluation of major groundwater basins to determine sustainable yield and overdraft status; a projection of California's groundwater resources in 20 years if current groundwater management trends remain unchanged; anticipated impacts of climate change on surface water and groundwater resources; and recommendations for state, federal and local actions to improve groundwater management. In addition, the Bulletin 118 update should identify groundwater basins that are in a critical condition of overdraft.

- **Improve Sustainable Groundwater Management**
  Groundwater is a critical buffer to the impacts of prolonged dry periods and climate change on our water system. The administration will work with the Legislature to ensure that local and regional agencies have the incentives, tools, authority and guidance to develop and enforce local and regional management plans that protect groundwater elevations, quality, and surface water-groundwater interactions. The administration will take steps, including sponsoring legislation, if necessary, to define local and regional responsibilities and to give local and regional agencies the authority to manage groundwater sustainably and ensure no groundwater basin is in danger of being permanently damaged by over drafting. When a basin is at risk of permanent damage, and local and regional entities have not made sufficient progress to correct the problem, the state should protect the basin and its users until an adequate local program is in place.

- **Support Distributed Groundwater Storage**
  The administration will support a comprehensive approach to local and regional groundwater management by funding distributed groundwater storage projects that are identified in groundwater management plans and removing barriers to implementation.

- **Increase Statewide Groundwater Recharge**
  The administration will work with the Legislature to discourage actions that cause groundwater basin overdraft and provide incentives that increase recharge. State agencies will work with tribes and federal, regional and local agencies on other actions related to promoting groundwater recharge and increasing storage, including improving interagency coordination, aligning land use planning with groundwater recharge, and identifying additional data and studies needed to evaluate opportunities, such as capturing and recharging stormwater flows and other water not used by other users or the environment.

- **Accelerate Clean-up of Contaminated Groundwater and Prevent Future Contamination**
  Throughout the state, groundwater basins are contaminated by historic manufacturing, farming practices and other current uses. The State Water Resources Control Board and the Department of Toxic Substances Control will develop recommendations and take action to prevent the spread of

contamination, accelerate cleanup, and protect drinking water in urban areas. The State Water Resources Control Board will continue to implement appropriate control measures to address these sources through its water quality permitting authority.

7. PROVIDE SAFE WATER FOR ALL COMMUNITIES

All Californians have a right to safe, clean, affordable and accessible water adequate for human consumption, cooking, and sanitary purposes. Disadvantaged communities, in particular, often struggle to provide an adequate supply of safe, affordable drinking water. The reasons for this are numerous: changes in drinking water quality standards, pollution, aging infrastructure, lack of funding for basic infrastructure, lack of funding for ongoing operation and maintenance, and unreliable supplies resulting in service interruptions are among the most common. Programs designed to protect the quality of our waters for drinking and other uses are housed in multiple agencies, reducing their effectiveness and ability to meet communities' needs.

- **Consolidate Water Quality Programs**
  The administration is pursuing consolidation of the drinking water and surface and groundwater quality programs into a single agency to achieve broader program efficiencies and synergies that will best position the state to respond to existing and future challenges. This initiative will also better restore and protect water quality and public health for disadvantaged communities.

- **Provide Funding Assistance for Vulnerable Communities**
  The administration will work with the Legislature to establish a stable, long-term funding source for provision of safe drinking water and secure wastewater systems for disadvantaged communities. The funding will be made available through a framework of statutory authorities for the state, tribes, regional organizations, and county agencies that will assess alternatives for providing safe drinking water and wastewater, including regional consolidation, and to develop, design, implement, operate and manage these systems for small disadvantaged communities impacted by contaminated drinking water and lack of sanitary wastewater infrastructure.

- **Manage the Supply Status of Community Water Systems**
  The state will identify drought-vulnerable public water systems and monitor the status of these systems to help prevent or mitigate any anticipated shortfalls in supply and to secure alternative sources of water for the communities when needed. The state will also work with local governments and agencies to identify drought-vulnerable areas served by domestic wells and collaborate to prevent or mitigate any anticipated shortfalls.

8. INCREASE FLOOD PROTECTION

California's exposure to flood risk presents an unacceptable threat to public safety, infrastructure, and our economy. More than 7 million people and $580 billion in assets are exposed to flood hazards in the state and the lack of sufficient and stable funding for flood management exacerbates the state's risk.

When California floods, public safety and health is endangered, critical infrastructure is damaged, vital services become isolated or interrupted, vast agricultural areas are rendered unproductive, and water supplies are threatened or impacted. The effects of climate change on the state's water runoff patterns will magnify these challenges. Actions by state, local, tribal and regional governments, however, can reduce flood risks and improve

the state's preparedness and resiliency when flooding inevitably occurs. Flood projects done in an integrated, regionally-driven way can also achieve multiple benefits. It is possible through collaborative planning efforts to integrate our flood and water management systems, and implement flood projects that protect public safety, increase water supply reliability, conserve farmlands, and restore ecosystems.

- **Streamline and Consolidate Permitting**
  The administration will convene a task force of federal, state and local permitting and flood management agencies, to develop a programmatic regulatory permitting process to replace current site-by-site mitigation requirements and expedite permitting of critical maintenance activities and flood system improvement projects. The effort to streamline and consolidate will also incorporate regional advanced mitigation as a means to expedite planning.

- **Create a Delta Levee Assessment District**
  The administration, in consultation with the Delta Protection Commission and the Department of Water Resources, will sponsor legislation establishing a Sacramento-San Joaquin River Delta levee assessment district with authority to collect fees needed to repair and maintain more than 1,000 miles of Delta levees, many of them privately constructed before modern engineering standards were in place.

- **Improve Access to Emergency Funds**
  The administration will sponsor legislation revising the California Disaster Assistance Act to enhance the Governor's Office of Emergency Services' ability to advance funds for flood response efforts in close coordination with the Department of Water Resources.

- **Better Coordinate Flood Response Operations**
  The Governor's Office of Emergency Services, working in coordination with the Department of Water Resources, the U.S. Army Corp of Engineers, and others, will develop and implement a common interagency protocol that all jurisdictions and agencies at all levels of government operating in the Delta in an emergency will use to establish joint field incident commands for flood operations and other emergency response functions.

- **Prioritize Funding to Reduce Flood Risk and Improve Flood Response**
  An estimated $50 billion is needed to reduce flood risk statewide. The administration will focus on the highest risk areas and develop proposals to fund projects through a combination of financing options.

- **Identify State Funding Priorities for Delta Levees**
  The Delta Stewardship Council, in consultation with the Department of Water Resources, the Central Valley Flood Protection Board, the Delta Protection Commission, local agencies, and the California Water Commission, should develop funding priorities for state investments in Delta levees. These priorities will be consistent with the provisions of the Delta Reform Act in promoting effective, prioritized strategic state investments in levee operations, maintenance, and improvements in the Delta for both levees that are a part of the State Plan of Flood Control and non-project levees.

- **Encourage Flood Projects That Plan for Climate Change and Achieve Multiple Benefits**
  State agencies engaged in planning and implementing flood projects, such as those outlined in the Central Valley Flood Protection Plan, will factor in the effects of climate change as well as pursue projects that provide the greatest number of benefits in addition to flood and public safety. Projects should be developed in a manner that anticipates the extremes that are predicted to worsen due to climate change, and pursue multiple benefits as a climate adaptation strategy like increasing water supply reliability,

giving rivers more room to move through widening floodways, conserving farmlands, and restoring ecosystems.

9. INCREASE OPERATIONAL AND REGULATORY EFFICIENCY

Efficiently operating the State Water Project and Central Valley Project, while complying with the requirements of state and federal endangered species acts and operating consistent with the conditions of water rights, contracts and other entitlements, is a delicate balancing act. Current coordination efforts, while longstanding and intended to cover a broad range of conditions, do not reflect the entire Delta watershed, nor do they effectively integrate all of the activities that other agencies and organizations are undertaking to improve the ecosystem.

- **Prepare for 2014 and Beyond Through Better Technology and Improved Procedures**
  The administration will work with federal and regional counterparts to improve coordination of operations of all major water supply (storage facilities and direct diversions), flood control, hatchery facilities, and habitat restoration projects to improve water supply and fishery conditions. The goals are to improve water project near-term operational flexibility for water year 2014 and build upon those actions in subsequent years. Better technology can result in improved coordination and more accurate data for decision making. Examples of better technology and improved coordination include but are not limited to the following:

  - Improve data availability, communication procedures, and analytical methods used to monitor and communicate risks to listed fish species and to water supplies when making regulatory decisions associated with implementation of incidental take provisions in the existing biological opinions.

  - Develop a pilot project to test if a new index for Old River and Middle River reverse flows enables compliance with biological opinion requirements.

  - Develop and employ new turbidity models to improve real-time turbidity management in the south Delta.

  - Analyze through the South Delta Science Collaborative associated operational approaches for minimizing loss of salmon in the area of the Old River barrier and effects of the operations on water supply.

  - Develop a Delta smelt life cycle model to help manage operations to avoid entrainment of smelt at the water project's intakes.

  - Implement a 3.5-year study to enhance and modernize Delta smelt monitoring (fish abundance and geographic distribution in the Delta), to improve the ability to protect fish populations while minimizing the impacts of fish protective measures on water project operations.

  - Work with federal agencies to improve coordination of hatchery fish releases with hydrologic conditions and water project operations to improve fish survival.

  - Improve state and federal interagency coordination and water contractor coordination on real-time forecasting and management associated with meeting water quality control objectives, to optimize project operations and avoid redirected fishery impacts.

- Fund and revive the National Hydrological Dataset for California to improve high-quality framework geospatial data and the precision and accuracy of mapping and scientific studies.

- **Improve and Clarify Coordination of State Bay Delta Actions**
  The problems affecting the Delta need to be addressed on multiple fronts, including habitat loss, export conveyance, water projects operations, pollution control, and flows. The principal state entities charged with addressing these issues are the Delta Stewardship Council, Department of Water Resources, Department of Fish and Wildlife, and the State Water Resources Control Board. Several federal agencies exercise regulatory authority related to these issues. There are also multiple water districts, private parties, nongovernmental organizations and tribal communities with a profound stake in these issues.

  A coordinated approach to managing the Delta is essential to serve the needs of California's residents. State agencies will commit to using collaborative processes to achieve water supply, water quality and ecosystem goals. This approach embraces enhanced sharing of data, consistent use of peer-reviewed science, coordinated review under the California Environmental Quality Act, improved integration of related processes, and encouragement of negotiated resolutions.

  - The Delta Stewardship Council, Department of Water Resources, Department of Fish and Wildlife, and the State Water Resources Control Board will ensure all relevant information is shared and will assist each other, as appropriate, to complete respective efforts to improve Delta conditions.

  - State entities will encourage negotiated agreements among interested parties to implement flow and non-flow actions to meet regulatory standards and support all beneficial uses of water. State staff will participate in these processes to the maximum extent possible when requested.

  - The Delta Stewardship Council's Implementation Committee, which includes leaders from all the affected state entities, will meet regularly to review progress in coordination.

  - The administration will direct relevant agencies and departments to work with the Delta Science Program, the Interagency Ecological Program, and others conducting science in the Delta to implement the Delta Science Plan, committing resources and funding for shared science to achieve integrated, collaborative and transparent science to enhance water and natural resource policy and management decisions.

10. IDENTIFY SUSTAINABLE AND INTEGRATED FINANCING OPPORTUNITIES

California has a long history of making sound financial investments in water resources. However, our current investments are not keeping pace with the need. Our infrastructure is aging, levees are in need of repair, communities are without safe water, and our environment, farms and economy are suffering from unreliable and degraded water supplies. The effects of climate change will only accelerate the challenges facing our water resources and infrastructure. This plan includes actions that will require multiple funding sources. We have access to a variety of funding sources including federal grants and loans, general obligation bonds, revenue bonds, rate payer dollars, local initiatives, user fees, beneficiary fees, local and statewide taxes, private investment, public-private partnerships, and more. A better understanding of the variety and types of funds and financing available for water investment will help us to make the best, most efficient and sustainable uses of the funding available.

- **Remove Barriers to Local and Regional Funding for Water Projects**
  The administration will work to clarify the 1996 Right to Vote on Taxes Act's (Proposition 218) applicability to water related fees and taxes, including sponsoring legislation if necessary.

- **Develop Water Financing Strategy**
  The administration will develop a water financing strategy that leverages various sources of water-related project funding and proposes options for eliminating funding barriers, including barriers to co-funding multi-benefit projects. The strategy will identify all potential funding sources for water-related projects including cap and trade auction revenue under AB 32, energy efficiency funds, user and beneficiary fees, polluter fees, local measures, and other sources and will establish principles to guide the use of these funding sources. The strategy will consider measures for energy efficiency and renewable energy to achieve greenhouse gas reductions that would be a co-benefit of water infrastructure investments.

- **Analyze User and Polluter Fees**
  The administration will direct agencies to identify areas where user and/or polluter fees may be appropriate. The agencies will assess the following: areas where users may not be fully funding the costs or impacts associated with their use, instances where polluters are not able to diminish their pollution and have not adequately accounted for the impacts of that pollution, and opportunities to use fees to incentivize positive behavior. The agencies will provide recommendations on fees, who would pay them, how they would be collected, and how they would be used.

Conclusion

All Californians have a stake in our water future. These actions set us on a path toward reliability, restoration, and resilience in California water. We must adapt to this "new normal" and recapture California's resource management leadership and our economic and environmental resilience and reliability. There are no silver bullets or single projects that will "fix the problem." We must have a portfolio of actions to comprehensively address the challenges this state faces. Some actions must be taken immediately to address current risks such as the looming drought and inadequate safe drinking water. Additionally, over the next five years, we must address fundamental changes in our approach to water resource management and be prepared for the changes the future holds.

Appendix C - Focus Group Working Papers

Waste Sector Working Paper

Introduction

Our vision for the Waste Management Sector for meeting GHG emissions and waste reductions goals out to 2050 is based on the principle that California must take ownership of the waste generated within the State. To carry out this vision, we must maximize recycling and diversion from landfills and build the necessary infrastructure to support a sustainable, low-carbon waste management system within California. We must also work with residents and producers to reduce the volume of waste generated. Enhanced collaboration with state and local agencies is necessary as California's waste- related issues are diverse and interconnected. Determining the best use of recycling alternatives, examining ways to increase the use of waste diversion alternatives and expanding their potential markets, obtaining funds and incentives for building the infrastructure, and evaluating the need for additional research to achieve GHG reductions and meet waste management goals are all actions that will be needed to reach our 2050 goals.

California must develop low-carbon, economically sustainable industries, technologies, and strategies that align with the state's long-term and integrated energy, waste, and environmental policy objectives. Waste has a critical role to play in enabling a sustainable, low-carbon future, in the context of each sector covered in the Scoping Plan. Waste sector-specific GHG and waste reduction targets and actions should align with the following overarching principles and priorities:

- Take Full Ownership of the Waste Generated in California
  - ✓ View waste as a resource
  - ✓ Develop a sustainable, low-carbon waste management system that processes collected waste within California
  - ✓ Eliminate, over time, the export of recyclable materials to other states or nations

- Maximize Recycling and Diversion from Landfills
  - ✓ Achieve continuous, measurable increases in the amount of materials recycled, reused, and remanufactured
  - ✓ Reduce the amount of organics and recyclable materials disposed of in landfills
  - ✓ Evaluate if regulator action is needed to phase out landfilling of organics

- Build the Infrastructure Needed to Support a Sustainable, Low-Carbon Waste Management System within California
  - ✓ Incentivize the most beneficial use of waste material based on California's economic, energy, waste, and environmental goals
  - ✓ Incentivize building new infrastructure within California for non-landfill alternatives

- ✓ Provide technical and economic support to ensure multiple waste handling, processing, treatment, and remanufacturing pathways in California
- ✓ Streamline air and solid waste permitting (including CEQA) for non-landfill alternatives
- ✓ Develop California-based post-processing and re-manufacturing capabilities
- ✓ Foster State, local, and private sector leadership to help build the infrastructure
- ✓ Ensure that environmental justice concerns are part of the decision making process

- Improve the Sustainability of California's Waste Management Infrastructure
  - ✓ Identify and support development of markets for recycled, reused, and remanufactured materials
  - ✓ Stimulate markets and demonstrate State leadership by establishing State purchasing and product end-of-life requirements
  - ✓ Stimulate new technologies that reduce GHGs and co-pollutants
  - ✓ Upgrade existing facilities as technology evolves to improve energy efficiency and reduce direct emissions
  - ✓ Reduce direct GHG and co-pollutant emissions from existing waste treatment options

- Reduce the Volume of Waste Generated
  - ✓ Educate all residents on their ability to help achieve California's waste management goals and reduce their carbon footprint
  - ✓ Enhance packaging and product optimization (longer lasting and easier to recycle)
  - ✓ Enhance producer responsibilities for hard-to-manage waste materials
  - ✓ Identify opportunities to reduce food waste

Our vision emphasizes a regional focus for integrated planning, project implementation, and governance for waste management. Successfully meeting our goals also requires reducing divergent state policies and effectively resolving conflicts between competing policy objectives.

Care should be taken to avoid misplaced investments that contribute to single or arbitrary milestones, conflict with other priorities, or otherwise divert resources from achieving long-term objectives.

The Waste Management Sector's continued contribution to meeting the 2050 GHG goals depends on the increased use of different waste alternative technologies and the push towards achieving net zero-emissions by Mid-term, between 2020 and 2050, and further reductions in direct GHG emissions by 2050.

A detailed summary of our vision, as well as how we will accomplish the vision (Follow-Up Actions) and background technical papers that were used to inform the vision are shown in the Appendix to this working paper.

The Waste Management Sector GHG Emission Goals for Mid-term and 2050

The following is a discussion of the proposed Waste Management Sector GHG emission goals for Mid-term and 2050 as well as the challenges and potential actions that can be done to accomplish the future GHG and waste reduction goals.

The proposed goals are as follows:

- Mid-term Goal: Achieve Net-Zero GHG emissions from the entire Waste Sector[1]
- 2050 Goal: Achieve a 25% reduction in direct GHG emissions from mid-term levels

<u>Achieving Net-Zero GHG emissions from the Waste Sector by Mid-term</u>
Beyond 2020, additional reductions in GHG emissions from the Waste Sector will be needed to achieve a Net-Zero GHG emissions goal. To achieve these reductions, even greater diversion of organics and other recyclable commodities from landfills must be realized and further expansion and enhancement of the alternative non-disposal pathways must be developed. In addition, greater emphasis will need to be placed on reducing the volume of waste generated, recycling/reusing products at the end-of-life, and remanufacturing these materials into beneficial products. To achieve Net-Zero, the direct GHG emissions from the Waste Sector would have to be fully offset by avoided GHG emissions. Avoided GHG emissions are reductions in life-cycle GHG emissions that would occur because waste is shifted from landfilling to alternative non-disposal pathways.

<u>Achieving a 25% reduction in direct GHG emissions from Mid-term levels by 2050</u>

As a 2050 goal, staff recommends a reduction of direct GHG emission in California from the Waste Sector to 25% below the direct emission associated with meeting the Mid-term goal.

Challenges and Potential Solutions to Meet the GHG and Waste Reduction Goals

The challenges to meeting GHG and waste reduction goals need to be addressed with the understanding that California must take full ownership for the wastes generated within its borders ("California Owns It"). Shipping waste, even recyclable products, to other state or nations is not a viable, long-term, environmentally appropriate, waste management practice for California. Furthermore, exporting waste denies California the economic opportunity of significant job growth that would result if these materials were

[1] Will need to quantify this in terms of a GHG reduction goal.

remanufactured in California. Some of the key challenges in achieving the stated goals are discussed below.

Infrastructure

The current waste management infrastructure will need to be expanded to accommodate the increases in recycling and remanufacturing of waste material that would occur in order to meet the GHG and waste reduction goals. This would mean more facilities and technologies that can use organics from the waste stream as well as more remanufacturing facilities for the various types of recycled material. This may also mean more sorting of material before disposal at the consumer level and may lead to more job opportunities in the waste management field.

Sources of funding will need to be secured in order for adequate infrastructure to develop, due largely to the relatively lowered cost of landfilling. Policies and regulations that encourage or promote the siting, permitting, building and operating of the facilities and/or technologies will be necessary. It is also essential, in this regard, for a streamlining of the permitting requirements of new and up-graded facilities and technologies for the waste management sector, while addressing cross-media regulatory issues. Facility operators may consider co-locating new waste treatment facilities at existing waste sites to minimize permitting issues and environmental impacts. In addition, it will be important to facilitate siting of new and upgraded waste management facilities with respect to length of time for approval, CEQA, and local community and regional planning and acceptance, including environmental justice concerns.

Technology

Some technologies that can be used to process the recovered waste material and for the remanufacturing processes still need to be developed and/or demonstrated. Funding is needed to incentivize the research, development and deployment of new, innovative technologies due to economic constraints. Additionally, incentives and funding may be needed to develop GHG-friendly sources of electricity and biogas from waste processing facilities.

Markets

As an increasing amount of recycled material is diverted and recovered from the landfills and the infrastructure for handling the recycled material is developed, markets for the recycled, reused, and remanufactured materials will need to grow. Coupled with the increased recycling is an increased amount of residual waste materials generated from non-disposal alternatives (such as ash from biomass combustion). Markets will need to be developed for these materials if non-disposable alternatives are to be viable in California. Alternatively, incentives and research of potential usage of the residual materials will assist with market build up.

Finally, to take ownership of the waste generated in California, state agencies must show leadership by purchasing products in keeping with the GHG and waste reduction goals. This will further increase the market for remanufactured materials.

Education

Another essential element in achieving the GHG and waste reduction goals is educating the public and government agencies on relative topics such as, the benefits of reducing GHG and waste, the various opportunities that can be taken to reduce GHG and waste in everyday activities, and taking responsibility for the waste that they generate. This could include outreach to the public agencies on the benefits of procuring products with low-waste or no-waste attributes, thereby reducing their carbon footprint. Additionally, education could be provided on packaging options and their impact on GHG and waste, as well as producer responsibilities, and reducing food wastes through more efficient farm, packing house, retail, and consumer practices.

Regulations and Policies

As mentioned, California's waste-related issues are diverse and interconnected impacting various state and local agencies. Therefore, the policies and regulations that are put in place to address these issues should be treated consistently across the agencies. Conflicting permitting and regulatory requirements must be avoided between agencies, districts, and jurisdictions. In addition, model permits and guidance documents are needed to streamline the permitting process and to assist project proponents for new and modified infrastructure projects. These actions will support the development of a low-carbon, sustainable waste management system in California.

Recommendations

In order to move forward with the Vision of the Waste Sector and achieve the future goals set for Mid-term and 2050, certain actions are recommended for the next five years to set the groundwork. These actions affect several broad areas within the Waste Sector and are necessary for reducing the challenges facing this sector. These recommendations include:

- Working with other agencies, districts, and jurisdictions to streamline the permitting process and address conflicting requirements, including cross media issues;
- Streamlining the permitting process for new and upgraded composting and anaerobic digestion facilities;
- Developing guidance documents and tools to assist in the permitting process and environmental reviews;
- Investigating regulatory or statutory actions to further reduce GHG emissions, including Best Management Practices and removal of organics at landfills;
- Identify and seek funding to incentivize activities to accomplish GHG and waste reduction goals;

- Developing new financial incentives for building adequate infrastructure in-state for non-landfill alternatives;
- Conducting research on the best use of waste management alternatives to further achieve the goals of the program;
- Revising the existing and developing new emission factors to better characterize emissions for various materials and processes including avoided landfill emissions;
- Addressing the obstacles and evaluate the feasibility of using biogas in natural gas pipelines;
- Identifying offset opportunities for various waste management alternatives, including recycling, compost, anaerobic digestion, and bioenergy processes;
- Initiating a public education campaign addressing goals of waste sector and benefits of increased recycling on carbon footprint;
- Improving the State procurement rates through education of purchasing officials, revision of current requirements, and product information system;
- Ensuring sustainability of current programs by establishing front-end processing standards for waste;
- Working with industry to standardize quality requirements of products from composting and anaerobic digestion;
- Determining the status of Municipal Solid Waste Thermal facilities and landfills in the Cap-and-Trade program; and
- Tracking the progress for achieving the AB 32 GHG emissions and AB 341 waste reduction goals.

Appendix
Overview of the Waste Management Sector, Six Technical Papers, and Follow-Up Actions

Introduction

Issues related to managing and utilizing California's waste resources are diverse and interconnected. Decisions addressing these issues will directly impact how and how quickly we achieve greenhouse gas (GHG) and waste reduction goals. These decisions will also have direct and indirect impacts on other sectors covered in the 2013 Scoping Plan Update. This document outlines the framework for developing a Waste Management Sector Plan and provides information critical to its development. This Overview is organized as follows:

1. Background – What is the purpose of this overview?
2. Process – How is the Waste Management Sector Plan being developed?
3. Principles and Priorities – What is the high-level, integrated vision for addressing waste-related issues?
4. Goal Setting – What are the GHG and waste reduction targets for 2020, Mid-term, and 2050?
5. Progress Measurement – What performance metrics will be used to track progress?
6. Implementation Mechanisms – What mechanisms will be used to achieve the principles and priorities, and goals identified in 3 and 4?
7. Key Challenges – What are the key challenges to meeting the GHG and waste reduction goals?
8. Follow-Up Actions – What actions need to occur, who is responsible, and what is the timeline for the actions?

1. Background - What is the purpose of this overview?

The purpose of this overview is to provide guidance and recommendations for developing a Waste Management Sector Plan for achieving California's GHG and waste reduction goals. It also serves to inform the Waste Management Sector element of the 2013 Scoping Plan Update. The Waste Management Sector includes all municipal and commercial solid waste-related activities (e.g., collection, processing, recycling, remanufacturing, treatment, or disposal) from generation to final disposition of the material within California.[2] When looking at the impact of waste reduction activities on GHG emissions, we will be evaluating net environmental impacts throughout the entire life cycle for these waste materials. That is, we will look at changes in the energy requirements beginning with the raw materials and ending when the material is no longer responsible for GHG emissions in California.

[2] Two waste streams that are not addressed in the Waste Sector Plan are medical wastes and hazardous wastes.

The 2008 Assembly Bill (AB) 32 Scoping Plan initiated the process of identifying opportunities to achieve GHG reductions from the Waste Sector. Control of landfill methane emissions was identified as an early action measure. The 2008 Scoping Plan also identified the need for mandatory commercial recycling and other programs to develop and implement alternatives to landfilling. In the Scoping Plan Resolution 11-32, the Board directed staff to work with CalRecycle and other stakeholders to characterize emission reduction opportunities for handling solid waste, including recycling, reuse, remanufacturing of recovered materials; composting and anaerobic/aerobic digestion; biomass conversion; waste thermal processes; and landfilling.

Further, in the Cap-and-Trade Regulation Resolution 12-33, the Board directed staff to propose a comprehensive approach for the most appropriate treatment of the Waste Sector under the Cap-and-Trade program based upon the analysis of emission reduction opportunities. This document outlines ARB and CalRecycle staff response to the Board's directives.

2. Process – How is the Waste Sector Plan being developed?

In response to the Board directive, ARB and CalRecycle established a joint workgroup to begin developing a Waste Management Sector Plan. The first task of this group was to prepare a series of background technical papers to assist in understanding the issues critical to the development of a Waste Management Sector Plan. The six technical papers cover:

- Recycling, Reuse, and Remanufacturing
- Composting and Anaerobic Digestion
- State Procurement
- Biomass Conversion
- Municipal Solid Waste Thermal Technologies
- Landfilling of Waste

Each paper provides a general description of the waste treatment process, discusses current activities, and identifies opportunities for greater GHG and waste reductions in the future. Each paper also discusses key challenges to achieving a sustainable, low-carbon waste management future and identifies potential solutions to those challenges. The six technical papers are provided in Appendix A.

In addition to the technical papers, staff has prepared a table of follow-up actions based on the findings and recommendation from the technical reports and stakeholder comments. The follow-up actions document is provided in Appendix B and will be updated regularly to address the dynamic nature of the implementation of the Waste Management Sector Plan.

3. Principles and Priorities - What is the high-level, integrated vision for addressing waste-related issues?

California's waste-related issues should be treated consistently in the development of the Waste Management Sector Plan and throughout the 2013 Scoping Plan Update, with the intention of developing low-carbon, economically sustainable industries, technologies, and strategies that align with the state's long-term and integrated energy, waste, and environmental policy objectives. Waste has a critical role to play in enabling a sustainable, low-carbon future, in the context of each sector covered in the Scoping Plan. Waste Sector-specific GHG and waste reduction targets and actions should align with the following overarching principles and priorities:

- Take Ownership of the Waste Generated in California
  - ✓ View waste as a resource
  - ✓ Develop a sustainable, low-carbon waste management system that processes collected waste within California
  - ✓ Eliminate, over time, the export of recyclable materials to other states or nations

- Maximize Recycling and Diversion from Landfills
  - ✓ Achieve continuous, measurable increases in the amount of materials recycled, reused, and remanufactured
  - ✓ Reduce the amount of organics and other recyclable materials disposed of in landfills
  - ✓ Evaluate if regulatory or statutory action is needed to phase out landfilling of organics with the goal of initial compliance actions in 2016

- Build the Infrastructure Needed to Support a Sustainable, Low-Carbon Waste Management System within California
  - ✓ Incentivize the most beneficial use of waste material based on California's economic, energy, waste, and environmental goals
  - ✓ Incentivize building new infrastructure within California for non-landfill alternatives
  - ✓ Provide technical and economic support to ensure multiple waste handling, processing, treatment, and remanufacturing pathways in California
  - ✓ Streamline air and solid waste permitting and siting of non-landfill alternatives
  - ✓ Develop California-based post-processing and remanufacturing capabilities
  - ✓ Foster State, local, and private cooperation in achieving the Waste Sector goals
  - ✓ Ensure that environmental justice concerns are part of the decision making process

- Improve the Sustainability of California's Waste Management Infrastructure
  - ✓ Identify and support development of markets for recycled, reused, and remanufactured materials
  - ✓ Stimulate markets and demonstrate State leadership by establishing State purchasing and product end-of-life requirements
  - ✓ Stimulate new technologies that reduce GHGs and co-pollutants
  - ✓ Upgrade existing facilities as technology evolves to improve energy efficiency and reduce direct emissions
  - ✓ Reduce direct GHG and co-pollutant emissions from existing waste treatment options

- Reduce the Volume of Waste Generated
  - ✓ Educate all residents on their ability to help achieve California's waste management goals and reduce their carbon footprint
  - ✓ Enhance packaging and product optimization (longer-lasting and easier to recycle)
  - ✓ Enhance producer responsibilities for hard-to-manage waste materials.
  - ✓ Identify opportunities to reduce food waste

Care should be taken to avoid misplaced investments that contribute to single or arbitrary milestones, conflict with other priorities, or otherwise divert resources from achieving long-term objectives.

4. Goal Setting - What are the GHG and waste reduction goals for 2020, Mid-term, and 2050?

The Waste Management Sector Plan and the Waste Sector Element of the 2013 Scoping Plan should identify 2020, Mid-term, and 2050 goals for GHG and waste reduction. The proposed goals are as follows:

- 2020 Goal: Achieve the AB 341 75% recycling goal and associated 20 to 30 MMTCO2e reduction
- Mid-term Goal: Achieve Net-Zero GHG emissions from the entire Waste Sector and associated GHG reductions[3]
- 2050 Goal: Achieve a 25% reduction in direct GHG emissions from Mid-term Net-Zero levels

2020 Goal: Achieve the AB 341 75% Recycling Goal and 20-30 MMTCO2e Reduction
With the adoption of AB 341 (Chesbro, Chapter 476, Statutes of 2011), a clear mandate was established to achieve a statewide recycling goal of 75% by 2020. Preliminary estimates are that about 22 million tons per year of material will need to be removed from the landfill waste stream and used in non-disposal alternatives by 2020. Achieving AB 341's 75% recycling mandate will result in an estimated 20 to 30 MMTCO2e reduction in 2020 compared to business as usual. Meeting these combined GHG and

[3] An estimate of the GHG emission reductions will be developed in the future.

recycling goals will require greater utilization of existing alternative pathways for waste processing and development of new alternative pathways. Existing alternative pathways include: enhanced recycling, reuse, and remanufacturing; composting; anaerobic and aerobic digestion; biomass conversion; and waste minimization. Additional pathways that can also achieve GHG reductions, but, by statute, would not count towards the 75% recycling goal, include municipal solid waste thermal technologies.

Mid-term Goal: Achieve Net-Zero GHG emissions from the Waste Sector
Beyond 2020, additional reductions in GHG emissions from the Waste Sector will be needed. To achieve these reductions, even greater diversion of organics and other recyclable commodities from landfills and further expansion and enhancement of the alternative non-disposal pathways developed to meet the 2020 goals will be needed. In addition, greater emphasis will need to be placed on reducing the volume of waste generated, recycling/reusing products at the end-of-life, and remanufacturing these materials into beneficial products. Staff proposes a Mid-term goal of Net-Zero GHG emissions for the Waste Sector. To achieve Net-Zero, the direct GHG emissions from the Waste Sector would have to be fully offset by avoided GHG emissions. Avoided GHG emissions are reductions in life-cycle GHG emissions that would occur because waste is shifted from landfilling to alternative non-disposal pathways.

2050 Goal: Achieve a 25% reduction in direct GHG emissions from Mid-term Net-Zero levels
As a 2050 goal, staff recommends a reduction of direct GHG emission in California from the Waste Sector to 25% below the direct emission associated with meeting the Mid-term goal.

5. Progress Measurement - What performance metrics will be used to track progress?

The Waste Management Sector Plan and the Waste Management Sector element of the 2013 Scoping Plan should identify how progress in meeting the GHG and waste reduction goals will be measured. These measurement tools must clearly identify issues so that corrective actions can be implemented if necessary. The proposed progress measurement approaches are as follows:

- Now – 2020: Waste Characterization Studies
- 2020 – Mid-term: Waste Characterization Studies, improved tracking systems, new innovative data collection approaches
- Mid-term – 2050: Waste Characterization Studies, further improvements in tracking, data collection, and data analysis

Now – 2020: Waste Characterization Studies
Measuring progress in meeting the 2020 goal (22 million tons of waste per year shifted from disposal and an associated 20 – 30 MMTCO2e reductions) would involve estimating the amount and type of waste going to a particular treatment option (i.e.,

landfilling, recycling, composting, etc.) using data obtained from the proposed 2014/15 and the 2019 Waste Characterization Studies. Waste reductions meeting the AB 341 2020 goal would be determined directly from the data obtained from the Waste Characterizations Studies. Progress in meeting the associated GHG emission reduction goal would be estimated taking the information provided by the Waste Characterization studies and calculating GHG reduction estimates for the amount and type of waste going to each treatment option. To estimate GHG reductions, new and updated emission reductions factors with need to be developed.

2020 – Mid-term: Waste Characterization Studies, improved tracking, enhanced data collection
Measuring progress in meeting the Mid-term goal will likely involve periodic Waste Characterization Studies, improved waste activity tracking, enhanced data collection and developing new and updated emission reduction factors.

Mid-term – 2050: Waste Characterization Studies, further improvements in tracking, data collection, and data analysis
Measuring progress in meeting the 2050 goal would focus on direct emissions from the Waste Sector and the impact of specific actions to reduce direct emissions from the collection, processing, reuse, and remanufacturing of waste. We envision that data collection would be more real-time and traditional Waste Characterization Studies would be replaced by automated tracking and data collection techniques. Improvements in information tracking and data sharing should allow great access to data being collected for other purposes.

6. Implementation Mechanisms - What mechanisms will be used to achieve the principles and priorities, and goals identified in 3 and 4?

The Waste Management Sector Plan and the Waste Management Sector element of the 2013 Scoping Plan Update need to identify what mechanisms or approaches will be used to implement program goals and targets. Implementation mechanisms could include voluntary measures, direct regulation, incentive-based program, bringing Waste Sector sources under Cap-and-Trade, or some combination of these options. It is also important to identify back-up approaches if the selected implementation mechanism is making insufficient progress toward achieving the identified goals. The proposed implementation mechanisms are as follows:

- Now - 2020: AB 341 75% Recycling Goal
- 2020 – Mid-term: New Direct Regulations or Cap-and-Trade Requirements
- Mid-term - 2050: To Be Determined

Now – 2020: AB 341 75% Recycling Goal

AB 341 established a clear mandate to achieve a 75% recycling goal (and associated GHG reductions) by 2020. Full implementation of the Commercial Recycling Regulation will achieve on the order of 3-5 MMTCO2e reductions but will not be sufficient by itself

to achieve the 75% mandate. CalRecycle is preparing a Report to the Legislature, due January 1, 2014, that will provide additional recommendations on how to achieve the AB 341 75% statewide goal. Much of this will likely entail financing of new recycling manufacturing infrastructure, continued focus on moving organic materials from landfills to other non-disposal uses, establishing new funding sources for local and state programs, establishing a broader extended producer responsibility framework, and clarifying the role of energy recovery.

For the Commercial Recycling component, it will be critical that ARB and CalRecycle closely monitor its implementation from now through 2020. If information from Waste Characterization Studies or other sources indicates that insufficient progress is being made to achieve the initial GHG reduction goal associated with the Commercial Recycling regulations or the AB 341 75% recycling mandate, then adopting direct source-specific regulations (i.e., restrict landfilling of organics) or bringing landfills and/or mass burn thermal technology facilities under Cap-and-Trade would become necessary.

2020 – Mid-term: New Direct Regulations or Cap-and-Trade Requirements

Beyond 2020, additional mechanisms may be needed to achieve the Net-Zero goal. Possible options include developing source specific regulations (i.e., restrict landfilling of additional recyclable commodities) or bringing Waste Sector sources under Cap-and-Trade.

Mid-term – 2050: To Be Determined

Mechanisms needed to achieve an additional 25% reduction in direct emissions by 2050 remain to be determined. Adjustments to existing regulations or Cap-and-Trade requirements, or developing new regulations may be needed. At the same time, a combination of voluntary, fee-based, or incentive programs may prove effective in providing further improvements to the waste infrastructure.

7. Key Challenges - What are the key challenges in meeting the GHG and waste reduction goals?

The challenges to meeting GHG and waste reduction goals need to be addressed with the understanding that California must take full ownership for the wastes generated within its borders. Shipping waste, even recyclable products, to other state or nations is not a viable, long-term, environmentally appropriate, waste management practice for California. Furthermore, exporting waste denies California the economic opportunity of significant job growth that would result if these materials were remanufactured in California.

Within the framework of “California Owns It”, challenges in achieving the GHG and 75% recycling goals are those associated with reducing generated waste and those

associated with developing non-disposal alternatives for handling waste that we generate.

Specific challenges to reducing the amount of waste generated in California include:

- Educating Californians to take responsibility for the waste they generate
- Evaluating what type of regulatory or statutory action is needed to phase out landfilling of organics
- Empowering the pubic to purchase products with low-waste or no-waste attributes, thereby reducing their carbon footprint
- Emphasizing packaging option and producer responsibilities
- Reducing food wastes through more efficient farm, packing house, retail, and consumer practices

Specific challenges to making non-disposal alternatives viable in California include:

- Developing financing options to achieve needed infrastructure expansion
- Streamlining permitting of new and up-graded facilities, including addressing cross-media regulatory issues
- Facilitating siting of new and up-graded waste management facilities with respect to length of time for approval, CEQA, and local community and regional planning and acceptance, including environmental justice concerns
- Developing markets for recycled, reused, remanufactured materials (such as paper) and for residual waste materials generated from non-disposal alternative (such as ash)
- Incentivizing purchase of GHG-friendly sources of electricity and biogas from waste processing facilities
- Showing State leadership by purchasing products in keeping with the GHG and waste reduction goals
- Co-locate new waste treatment facilities at existing waste sites to minimize permitting issues and environmental impacts

8. Follow-Up Actions - What actions need to occur, who is responsible, and what is the timeline for the actions?

For the Waste Management Sector, ARB and CalRecycle staffs have developed a "Follow-Up Actions" document based on the tasks identified in the technical papers: Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; State Procurement; Biomass Conversion; Municipal Solid Waste Thermal Technologies; and Landfilling of Waste. Follow-Up Actions serves as a working model to address the issues and activities associated with achieving the AB 32 GHG emissions and AB 341 waste reduction goals.

The Follow-Up Actions document is provided in Appendix B and includes:

- Ongoing activities related to the issues discussed above
- Additional activities and decisions that will need to be made in order to achieve the goals listed above
- Timelines for completing ongoing activities and initiating new activities

9. Appendices

- Appendix A, Technical Papers
    - Recycling, Reuse, and Remanufacturing
    - Composting and Anaerobic Digestion
    - State Procurement
    - Biomass Conversion
    - Municipal Solid Waste Thermal Technologies
    - Landfilling of Waste

- Appendix B, Follow-Up Actions

Appendix A – Technical Papers
RECYCLING, REUSE, AND REMANUFACTURING
January 2014

I. INTRODUCTION

This paper focuses on the opportunities, challenges, and potential solutions to achieve greenhouse gas (GHG) reductions from increased capture, reuse, and remanufacture of recyclable materials in the waste stream. For the purpose of this paper, recyclable materials include: recyclable fibers (paper, textiles, and carpet), plastic resins, glass, metals, lumber, wood waste, and inert materials.[4] Source reduction (including reuse) and recycling are at the top of the waste management hierarchy and the preferred approach to reduce GHG emissions from the Waste Management Sector. Both result in decreased GHG emissions from landfills; conserve energy; and reduce environmental impacts associated with the upstream production of materials, products, and packaging.

The sections that follow describe the waste collection and processing infrastructure in California, what happens with the collected recyclable materials, what are California's statewide recycling targets and the associated GHG emissions benefits, what are the challenges in meeting and exceeding these targets, and what actions may be taken to meet these challenges. This paper is one of several papers being prepared to provide information critical to the discussion about the role that the Waste Management Sector can and should play in meeting the goals of Assembly Bill (AB) 32.

II. GENERAL DESCRIPTION OF THE RECYCLING INFRASTRUCTURE IN CALIFORNIA

A. Collection

How are recyclable materials collected?

Recyclable materials are collected in a variety of ways including: a) collection program offered by a city, town, or county, or by private haulers under contract with a local governmental agency; b) back-hauling by businesses (or private hauling under contract) that develop their own strategies for collecting and handling recyclable materials; c) pickup of source-separated recyclables (e.g., only cardboard, only metal, only plastics) by independent recyclers; or; d) self-haul of recyclables to a recycling center, drop-off facility, or material recovery facility. Unlike traditional recycling materials, construction and demolition debris (C&D) is collected almost exclusively in large containers (e.g., drop-boxes) or in large bodied trucks (e.g., end-dumps) and might be collected by the municipality, private haulers, or independent recyclers depending upon the local collection system.

[4] Organic materials are addressed in the Biomass Conversion and the Composting and Anaerobic Digestion Technical Papers.

What portion of the collected material is capable of being recycled?

In 2010, about 73 million tons of waste materials were generated in California. Roughly 37 million tons of this material went into landfills and about 36 million tons were recycled. The 37 million tons landfilled includes disposal-related activities (i.e., alternative daily cover, alternative intermediate cover, and beneficial reuse at California landfills, material transformed at California transformation facilities, and tire derived fuel). Nearly two-thirds of the paper, plastic, and metal materials found in the disposed waste stream are uncontaminated when they arrive at disposal facilities and could be recycled into feedstock for reuse and remanufacturing facilities with minimal additional preprocessing.

B. Processing

How is collected material processed to recover recyclable material?

There are a variety of types of facilities where materials are sorted, consolidated, and prepared for end uses/markets. A material recovery facility (MRF) receives recyclables and sorts the materials by type or grade to meet the commodity specifications of the end use markets. The primary types of MRFs are Multi-Stream and Single Stream, and mixed-waste processing. At a Multi-Stream MRF, incoming recyclables have usually been collected separate from each other, for example through a curbside dual stream program that separates paper from glass, plastic, and metal materials. At a Single Stream MRF, incoming recyclables have been collected in one stream and often have a higher level of contamination than materials received at a Multi-Stream facility. A mixed waste processing facility (sometimes called dirty MRF) receives municipal solid waste which is then processed and sorted to recover recyclable commodities. Another MRF processing method is to collect wet (e.g., food) and dry (e.g., paper, clean containers) materials separately and process them separately at the MRF.

In addition, there are many facilities that focus on construction and demolition (C&D) materials. Aggregate, ready mixed concrete, and asphalt plants collect and recycle inert materials, primarily hardened concrete and asphalt. Mixed C&D processing facilities receive mixed construction and demolition debris which is then sent through a series of manual and automated sorting processes to extract the recyclable commodities. Mixed C&D facilities focus their efforts on recovery of heavy and bulky materials like wood, metal, concrete, asphalt, dirt, and cardboard. Some source separated C&D materials are also processed at MRFs. After the initial processing at a MRF or C&D processing facility, some recyclable commodities go through secondary processing to upgrade the value or utility of the material prior to use as feedstock in a remanufacturing facility.

What is the current capacity of the processing infrastructure in California?

The current capacity of the processing infrastructure is estimated based on information collected in CalRecycle's Facility Information Toolbox and is shown in Table 1. Not counting the 6.6 million tons per year in secondary processing, approximately 42 million

tons of materials are currently processed in California while 36 million tons of materials are recycled annually. The difference between the tons of materials processed and the tons of material recycled is attributed to residues from processing facilities that are landfilled or used for a disposal related activity. As shown in Table 1, there is adequate processing capacity at materials recovery facilities, construction and demolition processing facilities and secondary recyclables processing facilities to accommodate significant increases in handling collected materials and readying them for use in the next step.

Table 1. Number and Throughput of Facilities in the Processing Infrastructure[5]

Type of Facility	Number of Facilities	Current Throughput M tons/year	Remaining Capacity M tons/year
Material Recovery Facilities	137	11.9	16.9
C&D Processing Facilities	242	29.9	30.2
Secondary Recyclables Processing Facilities	223	6.6	3.1
Totals	**602**	**48.4**	**50.2**

III. CURRENT STATUS ON THE UTILIZATION OF RECYCLABLE MATERIALS

How are the recycled materials used in California?

Once recoverable materials are collected and sorted or processed, they are delivered to recycling/remanufacturing markets, either in California, elsewhere in the United States, or internationally. Significant quantities of glass and some of the metals, plastics, and paper that are collected for recycling in California remain in the state for remanufacturing. However, the majority of recyclable commodities collected in California for recycling are transported out of state by rail or ocean-going vessel. California's recyclable commodities, with a value of about $8 billion, constitute 28% of all California exports by sea[6]. Table 2 illustrates the remanufacturing destination of California's recycled materials.

[5] Throughput and capacity estimates from the CalRecycle Facility Information Toolbox (FacIT), September 2012, and are based on continually-updated data from industry operators, survey results, and self-reported data. http://www.calrecycle.ca.gov/FacIT/ -

[6] http://www.calrecycle.ca.gov/Actions/Documents/85/20132013/906/Export%20Report%20for%202012%20California%20Recyclable%20Materials.pdf

Table 2. Remanufacturing distribution of recycled materials in California[7]

Material	Remanufacturing Destination
Aluminum	99% Southeastern U.S., 1% Mexico, Europe, Brazil
Steel	90% Pacific Rim, 10% California
Glass	85% California, 8% Texas, Colorado, Washington, Oklahoma, 7% Mexico
HDPE	46% California, 36% in China, 18% Southeast U.S.
PET	77% China, 14% California, 10% Southeastern U.S.
Cardboard & Paper	64% U.S., 36% China

The number of remanufacturing facilities in operation in California, their throughput and their remaining capacities are tabulated in Table 3. As shown in Table 3, California's remanufacturing facilities handle a total of 2.3 million tons of material with little remaining capacity. Considering that there are 22 million tons of recyclable materials being exported from California and an additional 22 million tons of materials (including organics) currently being disposed in landfills annually that need to be recycled by 2020 in order to meet the AB 341 75% recycling goal (see Section IV), the information shows that there is a lack of recycling manufacturing capacity to handle increased amounts of materials that could be collected and processed. Inert materials from C&D facilities are excluded from Table 3 since additional remanufacture is not required as processing results in final products or commodities. For example, most of the concrete and asphalt is crushed and converted to aggregate during the initial processing for use as road base.

[7] http://www.arb.ca.gov/cc/protocols/localgov/pubs/recycling_method.pdf

Table 3. Number and Throughput of Facilities in the Remanufacturing Infrastructure[8]

Type of Facility	Number of Facilities	Current Throughput M tons/year	Remaining Capacity M tons/year
Glass Remanufacturing Facilities	13	0.7	0.1
Paper Remanufacturing Facilities	14	1.1	0.005
Plastic Remanufacturing Facilities	21	0.4	0.07
Tire Remanufacturing Facilities	74	0.05	0.04
Totals	**122**	**2.3**	**0.2**

With the existing remanufacturing infrastructure only handling a little over 2 million tons and having minimal remaining capacity, there is insufficient capacity to handle the recyclable materials for California to sustainably manage its own waste. This lack of recycling infrastructure for certain commodities and the state's close ties with the Pacific Rim make Asia one of the primary destinations for recyclable commodities. While international markets were a convenient and much-needed outlet for commodities over the past two decades, they are subject to global uncertainties. The 2008 worldwide economic downturn highlighted California's dependence on foreign markets for recycled materials. During the 2008 economic downturn, demand for recycled commodities decreased, commodity prices plummeted, and stockpiles of recycled commodities began to build up at material recovery facilities and ports, highlighting California's precarious reliance on export markets for recycled commodities. California's dependence on foreign markets has been illustrated again in 2013 with China's recent "Green Fence" policy that has adversely impacted export markets for recyclable commodities and re-emphasized the need to develop new, in-state remanufacturing capacity.

IV. GOALS FOR INCREASING RECYCLING/REMANUFACTURING AND ACHIEVING GHG BENEFITS

Using recycled commodities as feedstock for remanufacturing and energy production will achieve significant GHG reductions. In particular, reintroducing recyclables back into the manufacturing process reduces greenhouse gas emissions from multiple phases of product production including extraction of raw materials, preprocessing, and manufacturing. With the adoption of AB 341 (Chesbro, Chapter 476, Statutes of 2011), a clear mandate was established to achieve a statewide recycling goal of 75% by 2020. Preliminary estimates are that about 22 million tons per year of material will need to be removed from the landfill waste stream and used in non-disposal alternatives by 2020,

[8]Throughput estimates from FacIT may include virgin as well as recycled feedstocks. http://www.calrecycle.ca.gov/FacIT/

in order to meet this 75% goal. Achieving AB 341's 75% recycling mandate will result in an estimated 20 to 30 MMTCO2e reduction in 2020 compared to business as usual[9].

When looking at the impact of waste reduction activities on GHG emissions, future life cycle analysis on net environmental impacts will be needed. To estimate the GHG reduction benefits of recycling and remanufacturing, ARB has developed emission reduction factors (ERFs) for a majority of the materials that are recycled. Figure R-1 and Figure R-2 illustrate the amount of material and the corresponding GHG reductions that could be achieved by meeting the 75% recycling goal[10].

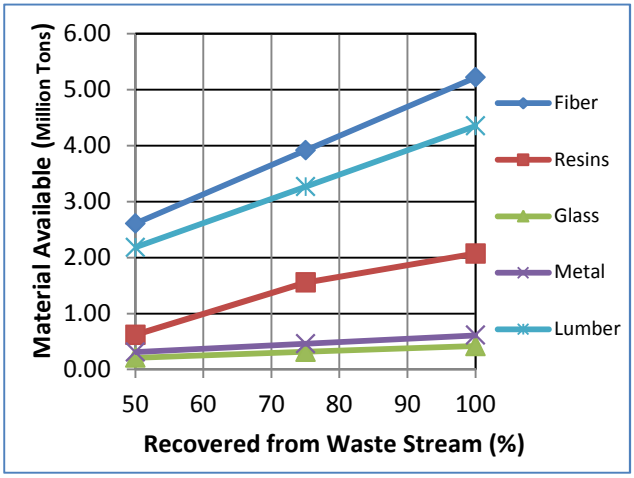

Figure R-1. Amount of Material Available

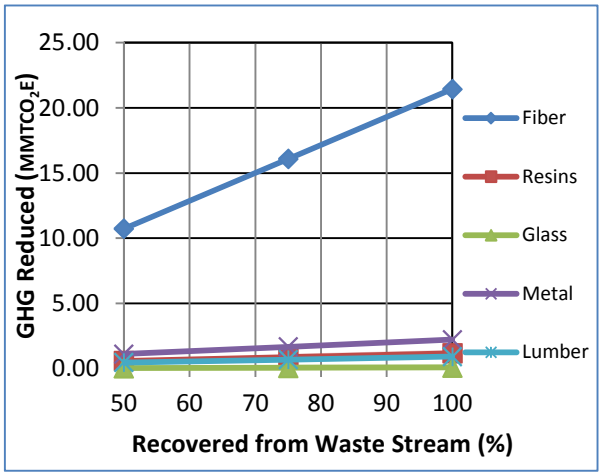

Figure R-2. Potential GHG Reduced

Beyond 2020, additional reductions in GHG emissions from the Waste Management Sector will be needed. Staff proposes a 2035 goal of Net-Zero GHG emissions for the Waste Management Sector. As a 2050 goal, staff recommends a reduction of direct GHG emission in California from the Waste Management Sector to 25% below the direct emission associated with meeting the 2035 goal. To achieve these reductions, even greater diversion of organics and other recyclable commodities from landfills and further expansion and enhancement of the alternative non-disposal pathways will be needed to meet the 2020 goals. In addition, greater emphasis will need to be placed on reducing the volume of waste generated, recycling/reusing products at the end-of-life, and remanufacturing these materials into beneficial products.

[9] Includes 5-6 MMTCO2e GHG emissions reduction by recycling organics. See the Composting and Anaerobic Digestion Technical Paper. Methodology for estimating the remaining amount of GHG emission reductions is shown in Appendix 1.

[10] Achieving the 75% recycling goal requires recycling organics in addition to these materials as addressed in the Biomass Conversion and Composting and Anaerobic Digestion Technical Papers.

Appendix C - Focus Group Working Papers

A. Existing requirements, programs, and regulatory policies

This section provides a summary of the existing regulations, policies, incentives and permitting requirements that influence the reuse and remanufacturing of recyclable materials.

How are processors and re-manufacturers of recycled products permitted to operate in California?

Remanufacturing facilities using clean, source separated, feedstock generally do not need a solid waste facilities permit (SWFP) but do require local land-use approval and environmental review under the California Environmental Quality Act (CEQA). Remanufacturing facilities may also require water and air permits and, depending upon facility discharges, environmental impact mitigations may be required. MRFs require a Solid Waste Facility Permit unless the incoming material is source-separated, contains less than 10 percent residuals and is less than 1 percent putrescible.

What regulations have an impact on recycling and remanufacturing recycled materials?

Regulations that have either a direct or an indirect impact on recycling and remanufacturing recycled materials are listed below:

- AB 939 - In 1989, the California Integrated Waste Management Act of 1989 (AB 939, Sher) was passed, which required cities and counties to reduce the amount of waste going to landfills by 25 percent in 1995 and 50 percent by the year 2000, through source reduction, recycling, and composting activities.
- AB 341 – In 2011, AB 341 established a policy goal of not less than 75 percent of the solid waste generated be source reduced, recycled or composted by 2020. AB 341 also requires businesses that generate 4 cubic yards or more of waste and multifamily residential dwelling of five units or more to recycle.
- AB 32 – AB 32, signed into law in 2006, established a first-in-the-world comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of GHG. Several measures in the Waste Management Sector have been identified under the AB 32 process for having GHG reduction potential.
- Cap-and-Trade – The Cap-and-Trade program is established under AB 32 to reduce GHG emissions. The program will cover major sources of GHG emissions in the State such as refineries, power plants, and other large industrial facilities which includes some manufacturers using recyclable materials as feedstock. The Cap-and-Trade program includes an enforceable GHG cap that will decline over time. ARB will distribute allowances, which are tradable permits, equal to the emission allowed under the cap.

- California Beverage Container Recycling and Litter Reduction Act (BCRLRA) (AB 2020, Sher, 1986) – This law sets a goal of recycling at least 80 percent of all beverage containers sold in the State by imposing a deposit of 5 or 10 cents per container, depending on size. The program helps ensure a steady supply of recycled aluminum, glass and plastic that can be used to manufacture new products. The law also created several programs to develop or enhance demand for recycled content products (see below).
- The Rigid Plastic Packaging Container (RPPC) law (SB 235, Hart, 1991) requires specified containers to meet one of several compliance options, including 25 percent recycled content. The program helps ensure manufacturing demand for California recycled plastics.
- The State Agency Buy Recycled Campaign (SABRC), a joint effort between CalRecycle and the Department of General Services (DGS), supports markets for recycled materials by requiring State agencies to purchase certain recycled-content products. The program implements several statutes, covering products such as paper, plastics, tire-derived products, compost and others. The product specifications, minimum recycled content levels, and purchase conditions vary by product.
- Several California “minimum-content” laws require manufacturers (or publishers, in the case of newspapers) to use minimum levels of recycled materials in products made, sold or used in California. These include glass containers (35 percent recycled content), newsprint (50 percent of newsprint used must have at least 40 percent recycled content), fiberglass (30 percent) and plastic trash bags (10 percent). Definitions of “recycled” and other specifications vary by product.
- Certain labeling laws indirectly support recycled-content manufacturing by ensuring truthful claims of recycled content or other environmental benefits. For instance, California law (Business and Professions Code Section 17580) requires product labels and advertisements to document such claims and to comply with the Federal Trade Commission “Green Guides” for environmental advertising. California also requires (Public Resources Code Sections18000 – 18016) rigid plastic containers to be labeled with resin identification codes to facilitate recycling.
- The Construction Demolition Inert (CDI) regulations in Title 14 of the CCR set statewide minimum handling requirements for facilities that transfer and process those materials.
- Caltrans currently has specifications that allow for the use of: up to100% recycled aggregate in road base, recycled and reclaimed concrete aggregate in some concrete applications, 25% reclaimed asphalt pavement (RAP) in hot mix asphalt (HMA), and 5% reclaimed asphalt shingles (RAS). Public Resources Code

Section 42704 allows Caltrans to develop a specification for the use of up to 40% RAP in HMA by 2014.

- Public Resources Code Sections 16000-16004 – Authorizes re-use of returned plastic concrete through reference to the Greenbook Standard Specifications for Public Works Construction.
- The California Green Building Standards Code (CALGreen), Title 24, Part 11 of the California Code of Regulations, requires that all construction and demolition residential and non-residential building projects, requiring a permit, must divert a minimum of 50% of construction waste materials generated.

What are some programmatic funding sources and incentives for recycling and remanufacturing recycled materials?

Some of the programs that provide funding and/or incentives for recycling and remanufacturing are listed below:

- Recycling Market Development Zones (RMDZ) loans - The intent of the RMDZ loan program is to help California manufacturers increase their processing capabilities and create additional markets for recycled-content products. Eligible applicants are businesses with manufacturing and processing facilities that produce recycled-content materials and products in designated zones in California. Funding for this program currently relies on repayment of principal and interest from prior loans, which typically amounts to only about $5 million or less per year.
- Beverage Container Recycling Program – Beverage containers covered under the Beverage Container Recycling and Litter Reduction Act (BCRLRA) are subject to California Redemption Value (CRV), a cash incentive of 5 cents for containers less than 24 ounces and 10 cents for containers 24 ounces or larger. Beverage producers also pay a “Processing Fee” to the State when the cost of recycling is greater than the scrap value of the recycled containers. CalRecycle disburses these fees and unclaimed deposits to pay for a variety of programs to increase recycling, reduce contamination and encourage use of the recycled materials. These include:
    - Direct payments to cities and counties to reduce costs of curbside collection and other local programs;
    - Collection and litter reduction grants to local jurisdictions, Conservation Corps and businesses;
    - Quality Incentive Payments to processors who sort and clean recycled beverage container material to specified standards;
    - Handling Fees and incentive payments to certified recyclers who increase collection;

    - Public education; and
    - Plastic Market Development Payments (PMDPs – see below).
- Electronic Waste Recycling Program – The Electronic Waste Recycling Act of 2003 and SB 50 (Sher, Chapter 863, Statutes of 2004) established a funding system for the collection and recycling of specified electronic wastes.
- Plastic Market Development Program (PMDP) – The PMDP provides $10 million or more per year to encourage both the processing and remanufacture of recycled beverage container plastics (primarily PET and HDPE) within California rather than outside the State. The payments are split between product manufacturers and reclaimers. Each company receives up to $150 per ton of CRV plastic processed and used to make a new plastic product.
- California Pollution Control Financing Authority (CPCFA) – CPCFA's Tax-Exempt Bond financing Program gives California businesses help with acquisition and installation of new equipment.
- Tax Credits – Federal and State tax credits may be available for green equipment purchases.
- Industrial Development Bond (IDB) Financing Program – California Industrial Development Financing Advisory Commission (CIDFAC) approves the issuance of IDBs, which provide manufacturing and processing companies low-interest financing for capital expenditures.
- Other programs that provide financial and other assistance include the Go-Biz program, Small Business Development Centers (SBDC), Service Corp of Retired Executives (SCORE) and Employment Training Panel (ETP) assistance.

V. CHALLENGES TO MEETING GOALS

This section discusses the current and future challenges to meeting the recycling and GHG reduction goals by increasing the reuse and remanufacturing of the recyclable materials in California. In general, there are a number of overarching challenges to increased recycling including: lack of sufficient domestic recycling infrastructure to remanufacture recycled materials, insufficient markets for recycled materials, and the relatively low cost of landfilling which adversely impacts the economics of recycling. The challenges to effectively and efficiently increase the reuse and remanufacturing of recycled materials can further be placed into short-term actions and long-term actions. Overall, California has sufficient capacity to process materials currently collected for recycling, but there is insufficient capacity to remanufacture these materials into products in California. Approximately 2 million tons of recycled materials processed in California are remanufactured into products in California while roughly 22 million tons of recycled materials processed in California are exported for remanufacturing. Furthermore, an additional 22 million tons of material needs to be recycled to meet the AB 341 75% recycling goal and there is insufficient remanufacturing capacity in California to turn these materials into products. Additional work is also needed to educate Californians to take responsibility for the waste they generate, to empower the

public to purchase climate-friendly products, to optimize product packaging, and encourage producer responsibility for recycling.

A. Short-Term

The first step in meeting the challenges to achieving these goals involves identifying and prioritizing immediate actions that could be taken to meet the 2020 GHG and waste diversion goals for the waste management sector. Some of the challenges to full utilization of the available recyclable materials are addressed below.

GHG emissions reduction quantification

- There is an insufficient number of emission reduction factors (ERFs) for alternative waste processing pathways (e.g., aerobic digestion) and materials that can be recycled (e.g., carpet), limiting the ability to quantify some potential reductions.
- Review California-specific data for benchmarking recycling facilities that are subject to Cap and Trade.
- Exported recyclables do not necessarily meet the same commodity standards as in-state markets and consideration of final destination, e.g., closed-loop recycling, downcycling, or incineration, should be included in GHG emission reduction factors.

Permitting and Siting New and Modified facilities

- Building new and up-grading existing facilities will face multiple challenges including: multiple permits and regulatory compliance requirements, the length of time for approval processes, CEQA issues, and local community and regional planning and acceptance, including environmental justice concerns.
- Lack of consensus that for California to meet its GHG and waste reduction goals there needs to be greater acceptance of ownership for the waste generated within California.

Financial limitations

- The relatively low cost of landfilling and the lack of financial incentives for non-landfilling alternatives may hinder increases in new facilities for remanufacturing.
- The Recycling Market Development Zone (RMDZ) program, which combines recycling with economic development to start new businesses, expand existing ones, create jobs, and divert waste from landfills, only serves half the geographic area of the State of California and has very limited sustainable funding.

Market Development

- Insufficient market demand for recycled, reused, and remanufactured materials (such as paper) and for residual waste materials generated from non-disposal alternatives (such as ash).
- Lack of adequate specifications and acceptance of the use of reclaimed or recycled C&D materials (RAS, RAP, etc.) into paving applications at both the state and local levels.
- There is a decreasing quality of collected materials due to trend towards more mixed collection of recyclables.

Regulatory Development

- Determine the need to develop additional regulations if necessary to achieve GHG and waste reductions goals.

B. Long-Term

Some of the long-term challenges include the following:

Infrastructure Improvements

- Increase in productions of remanufactured commodities or new remanufacturing facilities will require continuous infrastructure development.

Quality of recyclable commodities

- The need to foster collection of cleaner recyclable materials.

Identify future research

- How to best identify and fund future research that could be used to further achieve the goals of the program.

Ultimately take ownership for waste generated in California

- The need to develop a sustainable, low-carbon waste management system that processes waste in California and minimizes the export of waste-related materials to other states or nations.

VI. POTENTIAL SOLUTIONS

Building new recycling remanufacturing facilities could help California meet its GHG emissions and recycling goals while at the same time increasing our “ownership” of waste generated in California. Discussed below are some potential solutions to the challenges described above. As with the discussion of Challenges, the potential solutions are organized by short-term and long-term categories.

Appendix C - Focus Group Working Papers

A. Short-Term

GHG Emissions Reductions Quantification

- Develop new ERFs for alternative pathways for waste processing (e.g., aerobic digestion) and materials that can be recycled (e.g., carpet).
- Amend exiting ERFs as needed.
- Review Cap-and-Trade benchmarks for capped recycling manufacturing facilities (glass, paper, etc.) to ensure use of recycled feedstock is incentivized.
- Consider any additional quantifiable data on end use of exported recyclables and incorporate the information data into future updates to the RERFs as needed.

Permitting and Siting and Regulatory Compliance

- Work with other agencies, districts, and jurisdictions to identify and address conflicting permitting and regulatory requirements for recycling and remanufacturing facilities/operators.
- Develop a model permit that could be used to streamline the permitting process across several agencies.
- Create Programmatic EIRs and guidance documents to assist project proponents in the completion of environmental review and compliance with CEQA.
- Foster State, local, and private cooperation in achieving the Waste Management Sector goals and gaining public acceptance through public education outreach programs.

Financial Limitations

- Develop new financial incentives for building sufficient infrastructure in-state and ensuring the economic viability of various recycling pathways.
    - Explore potential offset project protocols for applicable recycling processes which may generate ARB offset credits.
    - Establish new incentive payments or loan/grant programs geared for the re-manufacturing of high-GHG commodities, for example through the use of Cap and Trade revenues.
    - Explore options such as tax credits and use of EPIC funds.
- Increase formal partnership with GO-Biz to further expand technical support for recycling and remanufacturing businesses.
- Expand sustainable financing for the RMDZ program and for recycling manufacturers throughout the State of California.
- Develop and implement product stewardship programs.

Market Development

- Increase markets for recycled products. This may be accomplished via incentives or requirements for increased recycled products purchasing by the State.

- Maximize recovery potential by establishing grants and/or performance standards for MRFs and C&D facilities to recover higher-quality commodities from mixed waste streams.
- Work with state and local transportation agencies on research, testing, and development of specifications for greater use and acceptance of reclaimed and recycled C&D materials in paving applications.
- Increase education of residents and businesses regarding the collection of cleaner recyclable commodities.
- Educate public on their responsibility to recycle, reuse and minimize their carbon footprint.

Regulatory Options

- Develop regulation(s) if needed to achieve GHG and waste reduction goals.

B. <u>Long-Term</u>

Infrastructure Improvements

- Develop a sustainable waste management system that can adequately handle the increase in municipal solid waste that needs to be shifted from landfill to remanufacturing processes to meet GHG and waste reduction goals.
- Foster State, local, and private cooperation in achieving the Waste Management Sector goals.

Improve the sustainability of the California waste management infrastructure

- Developing markets for recycled, reused, and remanufactured materials (such as paper) and for residual waste materials generated from non-disposal alternatives (such as ash).
- Evaluate the effectiveness of recycling education efforts and modify as needed to improve the quality of recyclable commodities.
- Develop and implement additional product stewardship programs.

Quality of recyclable commodities

- Maximize recovery potential by establishing grants and/or performance standards for MRFs and C&D facilities to recover higher-quality commodities from mixed waste streams.
- Increase education of residents and businesses regarding the collection of cleaner recyclable commodities.

Identify future research

- Identify future research (e.g., improved sorting, processing, and re-manufacturing technologies) that could be used to further achieve the goals of the program.

Reduce the volume of waste generated

- Maximize recycling of packaging materials.
- Evaluate opportunities to reuse materials.
- Enhance producer responsibilities for hard-to-manage waste materials.
- Continue to educate the public on their abilities to help achieve California's GHG and waste management goals.

Maximize Recycling

- Evaluate the effectiveness of the short-term incentives and modify as needed to achieve continuous, measurable increases in the amount of materials recycled, reused, and remanufactured.
- Incorporate recycling and recyclability as a front end design parameter for packaging and products.

Appendix 1: Waste Management Sector Greenhouse Gas Emission Estimates

Appendix 1 details the initial effort to estimate the greenhouse gas (GHG) emission reductions from the Waste Management Sector that will be realized by meeting AB 341's 75% recycling goal. The GHG emission reductions are presented for the Waste Management Sector as a broad range because they are dependent on many variables including:

1) Reliance on existing emission reduction factors. As noted in the Technical Papers and the Follow Up Actions, additional work is needed to improve the emission reduction factors and to develop new ones. Future work will include updating the emission reduction factors for landfills, including avoided methane emissions for organics that are shifted to non-landfill management alternatives. New emission reduction factors will be developed for anaerobic digestion and for additional recyclable materials such as carpet.
2) The expected composition of disposal related materials and materials recycled in 2020.
3) The variability of different materials within a general material category such as paper, and the variability associated with appropriate emission reduction factors. For example, there are different types of paper (corrugated cardboard, magazines, newspaper, white ledger paper, mixed paper, etc.), each with different estimated tonnages in the waste stream and each with associated emission reduction factors that depend on how much of these materials are recovered and how they are processed into beneficial products.

Thus there is a broad range of potential GHG emission reductions from the Waste Management Sector, on the order of 20 to 30 MMTCO2e. While this range will undoubtedly, due to obtaining new information and subsequent revised calculations, be refined over time, the bottom line is that there are significant GHG emission reductions that will be realized by achieving AB 341's 75% recycling goal.

2020 Waste Generation – Business as Usual (BAU) Scenario

In 2010, about 73 million tons of waste materials were generated in California of which roughly 37 million tons were disposal related (i.e. landfilling, alternative daily cover, alternative intermediate cover, beneficial reuse at California landfills, material transformed at California transformation facilities, and tire-derived fuel) and about 36 million tons were recycled. Under a business as usual (BAU) scenario, we estimate that waste generation will grow to 79 million tons by 2020. To estimate waste generation in 2020, CalRecycle selected the long-term average (1990 through 2010) per-resident waste generation rate of 10.7 lbs./person/day[11] multiplied by the 2020 population

[11] http://www.calrecycle.ca.gov/75Percent/Plan.pdf

estimate of 40.6 million from the Department of Finance[12]. Under a BAU scenario, where recycling remains constant at 36 million tons per year, California would generate an estimated 43 million tons of disposal-related material in 2020.

2020 Waste Generation, Increased Recycling, GHG Emission Reductions – AB 341 Scenario

In order to reach the 75% recycling goal of AB 341[13], about 22 million tons of the 43 million tons of disposal related materials in 2020 under a BAU scenario will instead need to be recycled. We have applied relevant emission reduction factors[14], including estimates for avoided landfill methane emissions[15] where appropriate, to the 22 million tons of waste recycled to estimate the range of associated GHG emission reductions. The GHG emission reduction calculations are based on the assumption that the composition of the waste recycled is proportionate to the composition of the waste going to disposal-related activities in 2010[16]. For example, paper, which constituted 15% of the disposal-related material in 2010, is assumed to constitute 15%, or 3.2 million tons, of the additional 22 million tons of material that needs to be recycled in 2020 to achieve the 75% recycling goal.

Table 1 below shows the composition of the waste stream and the estimated tons of the various material types that go to disposal-related activities in 2020 under a BAU scenario. The table also shows rough ranges for GHG emission reductions for the various material types if 22 million tons of these materials are diverted from the waste stream and sent to recycling, composting, anaerobic digestion, or biomass conversion facilities instead. By recycling the additional 22 million tons needed to achieve the AB 341 75% goal, we will also achieve roughly 20 to 30 MMTCO2e in GHG emission reductions[17]. Note that these emission reductions are based on best estimates of avoided landfill emissions and use existing Recycling Emission Reduction Factors (RERFs), Composting Emission Reduction Factor (CERF), and in some limited cases (i.e. metals, electronics, and carpet) factors from the USEPA WARM model. The Follow Up Actions commit to updating some of these factors as part of the overall Waste Management Sector Plan.

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[12] http://www.dof.ca.gov/research/demographic/reports/projections/P-2/

[13] About 22 million tons of additional recycling plus the 36 million tons of existing recycling will be needed to achieve the 75% recycling goal.

[14] http://www.arb.ca.gov/cc/protocols/localgov/pubs/compost_method.pdf; http://www.arb.ca.gov/cc/protocols/localgov/pubs/recycling_method.pdf As noted in the Technical Papers and the Follow Up Actions, additional work is needed to develop new and revise some of the existing emission reduction factors.

[15] As noted in the Landfill Paper, additional work is needed to quantify landfill emissions.

[16] We recognize that this composition assumption is not ideal; however, it is the best assumption given available data and is sufficient to provide an estimated range of GHG emission reductions.

[17] Note that GHG emission reductions are presented as a broad range because they are dependent on many variables. For example, there are many different types of paper (corrugated cardboard, magazines, newspaper, white ledger paper, mixed paper, etc.), each with different estimated tonnages in the waste stream and each with associated emission reduction factors that depend on how much of these materials are recovered and how they are processed into beneficial products.

Table 1: Estimated GHG emission reductions from Waste Management Sector

Material	% of Material Composition[18]	2020 BAU Disposal-Related Tons (million)	2020 GHG Emission Reductions (MMTCO2e) from increased Recycling, Composting, Anaerobic Digestion or Biomass Conversion
Paper[19]	15	6.3	8 - 10
Glass[20]	1.4	0.6	<0.5
Metal[21]	4	1.7	3 – 4
Plastics[22]	8.2	3.5	2 – 3
Food[23]	13	5.6	2 - 4
Green[24]	10.9	4.7	2 – 3
Lumber[25]	12	5.2	0.5 - 1
Other Organics[26]	9.5	4.1	3 - 4
Other Inerts	17	7.3	
Household Hazardous	0.3	0.1	
Special Waste	6	2.6	
Electronics[27]	0.5	0.2	<0.5
Mixed Residue[28]	2.5	1.1	< 0.5
Total[29]	**100**	**43**	**20-30**

[18] Differences from the 2008 Waste Characterization are attributable to the inclusion of 7 million tons of disposable related activities which were not included in the 2008 Waste Characterization Study (ADC, AIC, beneficial reuse, transformation, tire-derived fuel).

[19] **Paper:** There are different ERFs for the various types of paper (corrugated cardboard, magazines, newspaper, white ledger paper, mixed paper, etc.) ERF range of 0.54 - 5.53 MTCO2E/ton of material. Lower end of range estimate based on ERF of 0.3 MTCO2e/ton material (RERF) plus adjusted avoided landfill ERF of 0.24 MTCO2e/ton material (adjusted by ARB). Higher end of range estimate based on ERF of 5.0 MTCO2e/ton material (RERF) plus avoided landfill ERF of 0.53 MTCO2e/ton material (CalRecycle).

[20] **Glass:** ERF 0.2 MTCO2E/ton of material.

[21] **Metal:** There are different ERFs for the various types of metal. ERF range of 1.5 - 12.9 MTCO2E/ton of material.

[22] **Plastics:** There are different ERFs for various types of plastic. ERF range of 0.8-1.4 MTCO2E/ton of material.

[23] **Food:** ERF range of 0.66 to 0.95 MTCO2E/ton of material. Lower end of range estimate using (CERF) of 0.42 MTCO2e/ton material plus adjusted avoided landfill ERF of 0.24 MTCO2e/ton material (adjusted by ARB). Higher end of range estimate using (CERF) of 0.42 MTCO2e/ton material plus avoided landfill ERF of 0.53 MTCO2e/ton of material (CalRecycle).

[24] **Green:** IBID

[25] **Lumber:** ERF 0.21 MTCO2E/ton of material.

[26] **Other Organics:** ERF range of 0.66 to 0.95 MTCO2E/ton of material.

[27] **Electronics:** ERF of -2.35 MTCO2E/ton of material from USEPA Waste Reduction Model (Warm).

[28] **Mixed Residue:** ERF of 0.24 – 0.53 MTCO2e/ton material based on avoided landfill emissions.

[29] Numbers do not total exactly due to rounding.

COMPOSTING AND ANAEROBIC DIGESTION[30]
January 2014

I. INTRODUCTION

The primary focus of this paper is to identify opportunities and potential solutions for capturing organic materials that are currently landfilled and putting this material to a more beneficial use as feedstock for composting and anaerobic digestion. Successfully capturing a significant portion of this material for composting or anaerobic digestion is essential to ensure the success of meeting California's waste diversion and GHG reduction goals. In the sections that follow, staff describes how organic waste is processed in California, what happens with the end-use materials, what are California's waste reduction targets and the associated greenhouse gas (GHG) emissions benefits, what are the challenges in meeting and exceeding these targets, the potential solutions to these challenges, and next steps for evaluating the future of composting and anaerobic digestion in achieving Assembly Bill (AB) 32 and waste reduction goals.

II. GENERAL DESCRIPTION OF THE COMPOSTING AND ANAEROBIC PROCESSES

What are the processes involved in composting and anaerobic digestion?

Composting is the biological decomposition of biodegradable solid waste under controlled, predominantly aerobic conditions. Composting can be done at small-scale on-site facilities or at large-scale commercialized facilities that handle high volumes of organic material. Compost facilities have traditionally utilized open windrows to process compostable organics (mostly agricultural and green material) into finished compost. Some compost facilities incorporate more sophisticated technologies, such as aerated static piles and biofilters, to meet air quality requirements. End uses of the compost product include: soil amendment, fertilizer, mulch, boiler fuel, and a small amount used as alternative daily cover at landfills. The most common markets are agriculture and horticulture markets.

Organic material may also be processed via in-vessel digestion. Anaerobic digestion, the biological decomposition of organic material in the absence of oxygen or in an oxygen-starved environment, is the most common form of in-vessel digestion. Anaerobic digesters are fully enclosed structures, such as tanks or other sealed containers, in which the entire digestion process occurs. Anaerobic digestion produces biogas (consisting primarily of methane and carbon dioxide) and digestate. Digestate is the solid and/or liquid residual material remaining after organic material has been digested. There are a variety of controlled systems where anaerobic technology is

[30] Although anaerobic digestion, the biological decomposition of organic material in the absence of oxygen or in an oxygen-starved environment, is the most common form of in-vessel digestion, there are several other digestion technologies that do not utilize anaerobic digestion. Anaerobic digestion is used broadly throughout this paper and includes other lesser used technologies.

currently utilized in the United States, including wastewater treatment facilities (also publicly-owned treatment works), and dairy manure digesters. In other countries (primarily Europe), anaerobic technology is utilized in municipal solid waste digesters to produce energy and to reduce the volume of solid waste that must be landfilled. Products produced through anaerobic digestion include biogas, liquid fertilizer, and compost.

While, aerobic digestion technologies have been in use for a long time in waste water treatment plants (WWTP), the technology is being investigated for potential scale-up to commercial level production for organic materials from the waste stream. There is currently one demonstration facility in West Sacramento, California that has been in operation since June 2012. This technology uses freshly discarded food in its process. The current product from the demonstration facility is a liquid soil amendment that can be distributed via a drip system. The end-uses of compostable organics generated through aerobic digestion are soil amendments which reduces synthetic fertilizer use.

There are also other in-vessel digestion technologies that process organic material. For example, fermentation is the biological conversion of carbohydrates into acids or alcohol in the absence of oxygen and aerobic digestion is the biological decomposition of organic material in the presence of oxygen. While the term anaerobic digestion is used broadly throughout this paper, the general discussion applies to these other lesser-used technologies as well.

III. CURRENT STATUS OF COMPOSTING AND ANAEROBIC FACILITIES IN CALIFORNIA

A. Collection

How much organic waste is currently collected that could be diverted to composting and anaerobic digestion?

The composition of currently landfilled solid waste materials according to 2010 data is shown in Table 1. California disposes an estimated 37 million tons of waste in landfills each year, of which roughly 30 percent - more than 10 million tons per year - are compostable organic materials which are suitable for composting and anaerobic digestion. These compostable materials are food waste, green waste, a portion of other organics, and soiled (non-recyclable) paper. Total paper disposed of in landfills was about to 5.4 million tons, with an estimated potential of 39% of these being soiled paper. In addition, about 4.4 million tons of lumber are landfilled annually. Diverting compostable organics from the landfill and using it as feedstock in composting and anaerobic digestion processes will achieve significant GHG reductions as well as waste reduction goals.

Table 1. Composition of 2010 Landfilled Solid Waste[1]

Material[2]	Amounts (Million Tons[3])	Percentage of Solid Waste
Paper	5.4	14.7%
Glass	0.5	1.4%
Metal	1.5	4.0%
Plastics	3.0	8.2%
Food	4.8	13.0%
Green	4.0	10.9%
Lumber	4.4	12.0%
Other Organics	3.5	9.5%
Other Inerts	6.3	17.0%
Household Hazardous Waste	0.1	0.3%
Special Waste	2.2	6.0%
Electronics	0.2	0.5%
Mixed Residue	0.9	2.5%
Total	**37**	**100%**

1. Source: CalRecycle (2013)
2. Definitions of material types are available at: http://www.calrecycle.ca.gov/wastechar/MatDefs.htm
3. Numbers rounded to the nearest hundred thousand.

B. Capacity

How many composting and anaerobic digestion facilities are currently operating in California and what is the total capacity of these facilities?

Currently, there are almost 140 composting and anaerobic digestion facilities operating in California. Additionally, there are another 160 chip and grind facilities processing organics. Organic materials comprise a wide range of material types: grass, leaves, branches, prunings, stumps, wood waste, agricultural wastes, food waste, and biosolids. A range of facility types are needed to process these diverse materials: chipping and grinding, composting, and anaerobic digestion facilities. In addition, data from 2011 indicates that there are 22 biomass plants that handle about 1.5 million tons per year of urban wood waste combined with forest wood waste to make bioenergy. More recent data shows that the number of biomass plants have increased to about 30. Roughly 10 million tons per year of organic materials are recycled into beneficial products such as compost, mulch, biofuels, and bioenergy. Additional organics processing capacity is needed to handle about 15 million tons that are still being

landfilled annually which includes over 4 million tons of wood waste and nearly 5 million tons of food waste.

Chipping and Grinding **–** Chip/grind facilities primarily handle woody materials and do not complete a pathogen reduction process. There are about 160 chip/grind facilities processing 3.6 million tons of material per year. Markets for chip/grind material have been impacted by limited demand for chipped woody materials as a fuel for biomass facilities due to lack of incentives and inexpensive natural gas, competing interests of alternative daily cover at landfills, and concerns regarding land application of mulch products (e.g., pathogens, metals, salts, contaminants like glass or plastics, and invasive pests included in the mulch such as Asian Citrus Psylid or European Grapevine Moth). In fact, land application concerns may dictate that in the future this material should be handled at composting facilities to ensure pathogen and invasive pest destruction. There is some interest in high temperature drying of wood waste as well as gasification to produce electricity or fuel that if deployed commercially in California could increase market demand for woody wastes.

Composting – Compost facilities can handle diverse organic feedstocks, ranging from grass and leaves, branches and wood waste to biosolids, food waste, and digestate depending on the facility design and technology. Composting infrastructure expansion has remained stagnant over the past 10 years because of increased costs of air quality and water quality requirements, feedstock competition due to low landfill tipping fees and alternative daily cover use, and the need for increased demand and use of compost products. Due to these constraints, composting facilities are operating at roughly 70% of total statewide capacity leaving about 2.3 million tons/year of unutilized capacity. Currently, there are more than 130 composting facilities in California processing about 5.8 million tons of organic feedstock per year.

Anaerobic Digestion - There are currently six anaerobic digestion facilities in California handling organic materials from the waste stream with 0.14 million tons per year[31] of processing capacity. Because these facilities use in-vessel processing, they are particularly suited to handle food waste which has high intrinsic energy values and significant odor challenges. Anaerobic digestion technologies include co-digestion at WWTPs, dry fermentation, and high or low solids wet digesters. Currently, anaerobic digestion technologies at some WWTPs are receiving source separated, mostly liquid waste. Because WWTPs have infrastructure in place to handle and anaerobically digest organic waste, as well as excess digestion capacity, there is near-term potential for municipal solid waste digestion at these existing plants. In addition, these WWTPs have established facilities for handling wastewater from digestate dewatering and the processing of digested solids, as well as the biogas management facilities for generation of heat and power. For the other technologies, it is anticipated that 11 new anaerobic digestion projects under development will add 0.4 million tons per year of digestion capacity. With nearly 5 million tons of food waste still being landfilled, additional incentives are needed in order to achieve widespread deployment of

[31] The Inland Empire-Environ anaerobic digestion project has 0.08 million tons per year processing capacity but is currently operating significantly below capacity.

commercial scale anaerobic digestion facilities in California due to the economic disparity between the costs of landfilling versus anaerobic digestion. Additional anaerobic digestion of food waste will result in GHG emissions reductions in addition to production of renewable energy and new job creation.

C. GHG Emissions

What are the GHG emission benefits from diverting organic materials from landfills and sending it to compost or anaerobic digestion facilities?

Instead of landfilling, using organic material as feedstock for composting and anaerobic digestion can result in reductions of GHG emissions. The GHG emission reductions from these activities would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, and reduction in synthetic fertilizer and water usage.

Table 2 provides a rough estimate of the potential GHG emission reductions from diverting organic material from landfills to composting/digestion. In 2010, 37 million tons of wastes were disposed in California's landfills. Compostable/digestible materials, including food waste, account for roughly 30 percent (more than 10 million tons) of the disposed tonnage. If half of the compostable/digestible materials are diverted from landfills and are processed to usable beneficial products, the resulting GHG emissions benefits are estimated to be approximately 3.0 to 3.7 MMTCO2e. This emissions benefit includes reduced GHG emissions from avoided landfill emissions, decreased synthetic fertilizer usage, decreased water use, increased soil carbon storage, decreased soil erosion, and decreased herbicide use. When 75 percent of compostable/digestible materials are diverted from landfills in 2020 and beyond, which is needed in order to achieve the AB 341 75% recycling goal, the resulting GHG emissions benefits are estimated to be approximately 4.5 to 5.6 MMTCO2e per year. Most of the estimated GHG benefits would occur within California if the infrastructure and market challenges are resolved.

Table 2. Assessment of GHG Emission Benefits from Diverting Organics from Landfills

Process	**Organics Disposed in Landfills** (tons/year)	**Annual Tons Diverted** (50% of total disposed in years 2015 - 2020)	**Resulting GHG Emissions Benefits from 50% Diversion MMTCO2e per year** (2015 -2020)	**Annual Tons Diverted** (75% of total disposed in years 2020 and beyond)	**Resulting GHG Emissions Benefits from 75% Diversion MMTCO2e per year** (2020 and beyond)
Composting		2.5 million	1.65[1] – 2.38[2]	3.75 million	2.48[1] – 3.56[2]
Anaerobic Digestion		2.5 million	1.38[3]	3.75 million	2.06[3]
Total	10 million	5 million	3.03 - 3.76	7.5 million	4.54 – 5.62

[1] Estimated using Emission Reduction Factor (ERF) of 0.42 MTCO2e/ton material processed (ARB draft Mandatory Recycling Report) plus adjusted avoided landfill ERF of 0.24 MTCO2e/ton material processed (adjusted by ARB)

[2] Estimated using ERF of 0.42 MTCO2e/ton material processed (ARB draft Mandatory Recycling Report) plus avoided landfill ERF of 0.53 MTCO2e/ton material processed (CalRecycle)

[3] Estimated using ERF of 0.55 MTCO2e/ton material processed by HSAD (ARB LCFS report). As noted in the Follow Up Actions, additional work is on-going to include the downstream process emission benefits in the AD ERF in addition to the avoided landfill methane emissions benefits of AD that are included here.

Additional research is needed to better quantify the benefits from avoided landfill emissions and anaerobic digestion. Staff is presenting a range of emission benefits as some of the emission reduction factors are still considered preliminary and are presented here only to provide the reader with understanding of full potential for GHG emission reduction benefits.

Who currently regulates composting and anaerobic digestion facilities?

Compost and anaerobic digestion facilities are required to obtain permits from local land use and fire agencies, the local air district, the regional water board, and CalRecycle. Local air district permits are in accordance with the Clean Air Act and increasingly will include requirements to reduce fugitive emissions of volatile organic compounds, especially in non-attainment areas. New regulations are requiring facilities to implement best management practices (BMPs) such as using a compost biofilter cap or different technologies such as aerated static piles or in-vessel systems to meet Clean Air Act standards. Regional Water Board permits have generally required increasingly stricter standards for compost facilities since 2003 when a conditional waiver for “green waste-only” composting facilities was in effect. A change in the law required all waivers to either be renewed or replaced with Waste Discharge Requirements. For CalRecycle, compost and anaerobic digestion facilities are typically regulated Compostable

Materials Handling Operations and Facilities Regulatory Requirements, Title14, CCR 17850 et seq. These regulations take into consideration the type of feedstock, activity, location of the activity, and the volume of materials involved. The California Department of Food and Agriculture (CDFA) requires facility licensing and product registration and labeling of bulk compost intended for organic production, or for any compost sales where nutrient claims are made. Livestock and poultry carcasses from farms and parts or products of animals disposed of by United States Department of Agriculture and CDFA inspected slaughter and processing establishments, retail stores, and custom processors are required to go to CDFA licensed rendering plants, pet food processors or collection centers.

IV. GOALS FOR INCREASING COMPOSTING AND ANAEROBIC DIGESTION AND ACHIEVING GHG BENEFITS

The use of composting and anaerobic digestion processes can play a significant role in achieving California's goals for reducing GHG emissions and reducing the volume of material deposited in landfills. The GHG emission reductions from these activities would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, reduction in synthetic fertilizer and herbicide usage, decreases in soil erosion, and less water usage.

Discussed below are some of the existing state programs, regulation, and goals for reducing GHG emissions through composting and anaerobic digestion processes.

Are there established goals that must be met for the waste sector?

AB 32 and Executive Order S-3-05, established goals of reducing GHG emissions to 1990 levels by 2020 - a reduction of approximately 30 percent (20% AB 32 and 10% S-3-05), and then an 80 percent reduction below 1990 levels by 2050. These near and long-term goals will guide the process in evaluating the waste sector, pointing to a sustainable, low-carbon and near-zero-waste future.

With the adoption of AB 341 (Chesbro, Chapter 476, Statutes of 2011), a clear mandate was established to achieve a statewide recycling goal of 75% by 2020. Preliminary estimates are that about 22 million tons per year of material will need to be removed from the landfill waste stream and used in non-disposal alternatives by 2020. Achieving AB 341's 75% recycling mandate will result in an estimated 20 to 30 MMTCO2e reduction in 2020 compared to business as usual. Meeting these combined GHG and recycling goals will require greater utilization of existing alternative pathways for waste processing and development of new alternative pathways. A significant portion of the solid waste is compostable/digestible organics. Diverting organic waste from landfilling and using it as feedstock in composting and anaerobic digestion processes will achieve GHG reductions and will be critical in achieving our waste reduction goals.

Are there other regulations, policies, or programs that provide incentives for composting and anaerobic digestion?

Additional programs that provide incentives to advance composting and anaerobic digestion are shown in Table 3 below.

Table 3: Additional Programs that Provide Incentives for Composting and Anaerobic Digestion

Regulatory Programs	Description
Landfill Methane Control Measure	This measure reduces emissions of methane, a GHG, from MSW landfills by requiring installation of control equipment and good operating practices.
Cap-and-Trade Program	The Cap-and-Trade program is established under AB 32 to reduce GHG emissions. The program will cover major sources of GHG emissions in the State such as refineries, power plants, and other large industrial facilities. The Cap-and-Trade program includes an enforceable GHG cap that will decline over time. ARB will distribute allowances equal to the emission allowed under the cap. It is estimated that about 23 manufacturing facilities that use recyclable material as feedstock are currently under the Cap-and-Trade program.
Low Carbon Fuel Standard (LCFS)	The LCFS requires fuel producers to ensure that fuels sold in California would meet a declining standard for GHG emissions. This regulation is likely to incentivize and provide a market for biogas.

Renewable Portfolio Standards (RPS)	RPS applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities must adopt the new RPS goals of 20 percent of retail sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020. This regulation is likely to incentivize and provide a market for biogas.
AB 1900 (Gatto, 2012) and AB 2196 (Chesbro, 2012)	AB 1900 requires the Office of Environmental Health Hazard Assessment (OEHHA) to determine the health protective levels for all constituents of concern that appear in biogas at concentrations significantly higher than in natural gas that could pose risks to human health. The California Air Resources Board (ARB) then must determine the allowable concentrations of those constituents. Under AB 1900, the California Public Utilities Commission (CPUC) must also establish safety standards, monitoring and reporting requirements, and open pipeline access rules for the use of biomethane. Further, it must adopt policies that promote in-state production and distribution of biomethane. Additionally, the State Energy Resources Conservation and Development Commission (a.k.a. California Energy Commission or CEC) must hold public hearings to identify impediments to the procurement of biomethane in the State, and offer solutions to those impediments in its biennial Integrated Energy Policy Report. Among other things, AB 2196 amends the definition of a renewable electrical generation facility under the California Energy Commission's Renewable Energy Resources Program.

Funding Programs	Description
AB 118 (Núñez, Statutes of 2007, Chapter 750)	Directs the California Energy Commission (CEC) to develop the Alternative and Renewable Fuel and Vehicle Technology Program. Implementation of this program can provide funding in furthering the use of anaerobic digestion in producing renewable energy.
Recycling Market Development Zones (RMDZ) loans	The intent of the RMDZ loan program is to help California manufacturers increase their processing capabilities and create additional markets for recycled-content products. Eligible applicants are businesses with manufacturing and processing facilities in California that produce recycled-content materials and products.
California Pollution Control Financing Authority (CPCFA)	CPCFA's Tax-Exempt Bond financing Program gives California businesses help with acquisition and installation of new equipment.
Tax Credits	Federal and State tax credits may be available for green equipment purchases

Other programs that provide financial and other assistance include the Go-Biz program, Small Business Development Centers (SBDC), Service Corp of Retired Executives (SCORE) and Employment Training Panel (ETP) assistance.

V. CHALLENGES TO MEETING GOALS

Currently, about 30 percent of the solid waste going into landfill is comprised of materials, such as food and green waste, which are suitable for composting and anaerobic digestion. Successfully capturing a significant portion of this material for composting and anaerobic digestion is essential to ensure the success of meeting California's waste diversion and GHG reduction goals. This section discusses the current and future challenges facing increases in composting and anaerobic digestion. The challenges discussed below are further divided into short-term and long-term actions.

A. Short-Term

The first step in meeting the challenges involves identifying and prioritizing immediate actions that could be taken to meet the 2020 GHG and waste diversion goals for the waste sector. Some of the challenges to increasing the use of composting and anaerobic digestion technologies are addressed below.

GHG Emissions Reduction Quantification

- To better understand the role composting and anaerobic digestion can play in meeting our GHG and waste reduction goals, the direct and avoided emissions from the use of these technologies need to be analyzed and quantified.

Permitting of New and Expansion of Existing Composting and Anaerobic Facilities

- Cross media and multi-jurisdictional challenges including: multiple permits and regulatory compliance requirements, the length of time for approval processes, CEQA issues, federal law issues, and local/regional planning and acceptance, including environmental justice concerns.
- Lack of consensus that for California to meet its GHG and waste reduction goals there needs to be greater acceptance of ownership for the waste generated within California.

Financial Risk

- The relatively low cost of landfilling and the lack of financial incentives for non-landfilling alternatives may hinder increases in composting and anaerobic digestion.

Market Development

- Markets for compost and digested commodities are not adequate to accommodate what is needed to reach the waste reduction goals.
- Insufficient organics pre-processing close to feedstock sources to remove contaminants.

Regulatory Development

- Determine the need to develop additional regulations to achieve GHG and waste reduction goals.

Public Acceptance

- There are difficulties in siting compost or anaerobic digestion facilities in proximity to urban areas where most of the compostable organics are generated. There is currently low public acceptance of these facilities in these neighborhoods.
- Contamination in green and food materials, in particular post-consumer materials, increases operating costs for processors and can adversely affect the salability of compost and digestate made from these materials.

B. <u>Long-Term</u>

Some of the long-term challenges, those beyond 2020, include: developing the needed infrastructure, increasing the markets for composted or digested commodities, improving the quality of composted or digested commodities, and addressing research needs

Infrastructure Improvements

- Increases in production or use of compost and end products of the anaerobic digestion technologies will require continuous infrastructure development.

Market Development

- Glass and plastic contaminants are difficult to remove from feedstocks and finished products.
- Benefits of composted products are often undervalued as an agricultural input.

Future Research

- Identify and fund future research needs to achieve the stated goals.

VI. POTENTIAL SOLUTIONS FOR MEETING GOALS

Discussed below are some potential solutions to the challenges described above in our effort to achieve waste diversion and GHG reduction goals. As with the discussion of "Challenges," the potential solutions are organized by short-term and long-term categories. There may be additional solutions to the challenges beyond those mentioned below.

A. Short-Term

The key to determining the most efficient and effective solutions for reducing GHG emissions and achieving the waste management goals are by continuing to evaluate possible strategies and prioritizing immediate and future actions. To this effect, staff has identified some potential solutions to overcome some of the short-term challenges stated above. Some of the short-term solutions include:

GHG Emissions Reduction Quantification

- Revise the compost emission reduction factor to include avoided landfill emissions.
- Develop new emission reduction factors for the anaerobic and aerobic digestion processes which include the GHG benefits of any renewable energy or liquid fuels produced.
- Complete research on GHGs from compost production and use.

Permitting of New and Expansion of Existing Composting and Anaerobic Facilities

- Continue to work with other agencies, districts, and jurisdictions to identify and address redundant or conflicting permitting and regulatory requirements for composting and anaerobic digestion facilities/operators.
- Prepare a programmatic EIR and/or model permits for compost facilities that provide enhanced air and water quality protection and odor control.
- Support the co-location of organics processing at existing WWTPs and landfills, including integrated facilities that combine composting, AD, low-carbon electricity and fuel production, or other related processes.

Financial Risk

- Develop incentive payment and/or grant programs for compost and anaerobic digestion organics infrastructure that processes organic materials while providing environmental protection and GHG reduction.
- Identify opportunities and develop the framework for composting and anaerobic digestion activities to be a source of GHG offsets. Offsets could provide funding to build and expand infrastructure, reduce the cost differential between these activities and landfilling, or provide emission offsets for new facilities.
- Investigate the feasibility of criteria pollutant offset banks for new composting facilities, and the generation of offsets by upgrading existing facilities to reduce emissions.
- Continue to provide regulatory certainty that fuel produced from anaerobic digestion of organic waste can qualify for Low Carbon Fuel Credits.
- Provide funding for facility improvement to meet air, water, and environmental justice goals.
- Establish feed-in-tariffs for electricity production to make in-state renewable energy production more competitive with low-cost natural gas.
- Increase AB 118 funding to make more funding available for anaerobic digestion projects.
- Continue pursuing pathways for Low Carbon Fuel Credits for anaerobic digestion.
- Expand sustainable financing for the RMDZ program and for compost and digestion facilities throughout the State of California.
- Take advantage of technical support through GoBIZ.

Market Development

- Provide incentives to move materials out of landfills.
- Disallow the use of green waste Alternative Daily Cover (ADC) to count as recycling.
- Increase compost and anaerobic digestion products purchasing by Federal, State and local government agencies.
- Increase agricultural, rangeland and landscaping markets for composting and anaerobic digestion products. This may be accomplished via financial incentives and promoting the highest standards for product safety and quality.
- Support third-party product-quality standards for composted and digested products.
- Work with stakeholders to promote the sorting of urban organics, particularly food, at transfer stations, MRFs and other locations, in order to provide clean feedstocks for composting and digestion.
- Support development of advanced processes and/or equipment that enables cost-effective removal of contaminants from the organics waste stream, particularly glass and plastic.

Regulatory Development

- Complete updates to CalRecycle regulations for composting and anaerobic digestion of food materials and other highly putrescible wastes.
- Consider ARB regulations requiring phasing organics out of landfills and into composting and anaerobic digestion alternatives.
  Consider mandatory organic waste recycling for large commercial generators.

Public Acceptance

- Outreach and education to the public on the benefits of using products derived from organic residuals, and to encourage the public to correctly sort organics materials.
- Promote next-generation composting facilities that minimize odors and emissions and can be sited closer to urban centers.

B. <u>Long-Term</u>

Staff has identified some potential solutions to overcome some of the long-term challenges stated above. Some of the long-term solutions include:

Infrastructure Improvements

- Develop a sustainable waste management system that can adequately handle the increase in municipal solid waste that needs to be shifted from landfill to compost and anaerobic digestion processes to meet GHG and waste reduction goals.
- Foster State, local, and private cooperation in achieving the Waste Sector goals.
- Encourage new technologies that handle food waste and make value-added products such as fuels or fertilizers.

Market Development

- Continue to support incentives, education, and product quality standards for compost and anaerobic digestion products that will increase demand from agricultural markets.

Future Research

- Improve the characterization of the direct and avoided GHG emission from composting and anaerobic digestion of organic waste.
- Characterize the properties of the digestate from anaerobic systems and determine its suitability for various uses.
- Continue to support research and development projects demonstrating the newest best management practices for composting and anaerobic digestion processes.
- Investigate carbon sequestration and water savings potential of compost use in agricultural settings such as irrigated croplands and rangelands.

STATE PROCUREMENT
January 2014

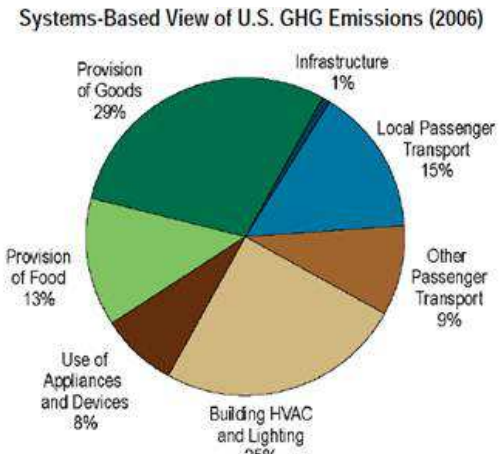
I. INTRODUCTION

Procurement decisions made by State agencies and departments are directly linked to the climate change goals of AB 32 and the recycling goals of AB 341. These decisions impact the greenhouse gas (GHG) emissions and the carbon footprint of State operations, and offer an opportunity to increase markets for post-consumer recycled content (PCRC) products, which will be critical in helping to achieve AB 341's 75% Statewide recycling goal.

The State of California purchases large volumes and a wide variety of goods. The State spent approximately $12.8 billion on services and $1.5 billion on goods in 2012 (which was a relatively low-spending year due to budget cuts). The Department of General Services (DGS), which is the central purchasing authority for all State agencies, CalRecycle, and other State agencies have programs that influence procurement decisions.

As an illustration of how purchasing can impact GHG emissions, a study prepared for Cal/EPA and the ARB[32] suggests that significant life-cycle GHG emissions reductions can be achieved via use of product carbon labels and procurement of PCRC products. In addition, a U.S. Environmental Protection Agency (USEPA) study[33] shows that over 40 percent of GHG emissions are associated with the provision of goods and food as indicated in Figure 1.

Figure 1:



Emissions from U.S. Territories are not included in this figure.

[32] http://www.arb.ca.gov/research/single-project.php?row_id=64820

[33] "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices", U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, September 2009.

DGS and CalRecycle have made major strides in recent years in promoting the purchase of environmentally preferable products (EPP) and PCRC products. However, as described below, only a small portion of overall State spending, less than $200 million annually, is known to be on PCRC products; how much of the overall $14 billion in State goods and services might be for products that could entail PCRC is unknown. Based on existing purchasing data, it is difficult to determine which products to focus our efforts on, and which agencies purchase these products and how they purchase them. Additional data is needed in order to know how to modify current purchasing practices that will result in reduced GHG emissions and increased markets for PCRC products.

These challenges are not insurmountable but will require a high degree of collaboration among State and local government agencies, goods providers, and end users. Improvements can be made throughout the State purchasing system including:

- standardize tracking all State purchases (CalCard, Request for Quotes, leveraged procurement agreements, and service contracts),
- ensure that all purchasing mechanisms (state contracts, delegated authority contracts, and service contracts that include goods procurement) incorporate recycled-content requirements and considerations ,
- identify statutory changes to improve/expand recycled-content products purchasing, and
- require product manufacturers to provide environmental information on their products and improve availability of this information to individuals making purchasing decisions.

II. BACKGROUND/OVERVIEW

Understanding and influencing procurement decisions requires basic data on what goods are purchased, by whom, and in what volumes. Given the wide variety of goods purchased each year by a multitude of State agencies, this is not an easy question to answer. DGS is responsible, in consultation with the California Environmental Protection Agency (CalEPA, represented by CalRecycle and other CalEPA departments), for implementing the EPP program pursuant to Public Contract Code Section 12400. In response to PCC 12400, the DGS/EPP Program has been integrated into the State contracting procurement process by reviewing the commodities being procured and analyzing opportunities for establishing specifications that incorporate EPP where applicable or achievable. As evidenced by purchasing data presented below, there are significant data gaps on whether all state purchases use prescribed EPP contracting processes for the vast amount and types of products purchased by the state.

As part of the EPP program, DGS has established the Performance and Environmental Standards (PES) Workgroup in 2013, which is comprised of State agency purchasing authority representatives and subject matter experts to encourage green purchasing and to assist DGS in developing EPP policy. State agencies in the PES, and prior

workgroups, have been engaged in developing EPP policy memorandums for commodities such as, remanufactured toner cartridges, architectural paint, and paper products. One of the PES objectives is to aid in developing specifications and/or purchasing standards that include EPP for use by all agencies (to ensure EPP and postconsumer recycled content requirements are considered and used when state agencies buy under their purchasing delegation authority). DGS has also developed several Statewide contracts that are available through its *Buying Green Guide* (e.g., ink and toner cartridges, copy paper, computers/monitors, multi-function devices, recycled paint, open office panel systems, disposable food service supply, and vehicles). These "green" contracts incorporate multiple environmental (i.e., EPP) considerations, and often include minimum levels of post consumer recycled content to conform to State Agency Buy Recycled Campaign (SABRC) requirements. State agencies can use these contracts when purchasing those products, although most State agency purchasing appears to be conducted via other mechanisms. The EPP Program is exploring a system to capture EPP purchases from DGS contract mechanisms. In addition, DGS offers training through the California Procurement & Contracting Academy on EPP principles and how they are incorporated into the procurement process.

CalRecycle is responsible for the SABRC, pursuant to Public Contract Code Sections 12153-12320, under which State agencies have mandated goals regarding the purchase of post-consumer recycled content products. State agencies are required to report annually to CalRecycle the results of their recycled content purchases within 11 categories of material types. Products with post-consumer recycled content provide multiple benefits to California (e.g., increased economic development, reduced pollution and lower greenhouse gases) and by purchasing these products the State supports businesses making PCRC products and influences recycling markets. According to SABRC reporting, in 2011/2012 State agencies spent more than $185 million in SABRC purchasing categories; about $130 million of these purchases were PCRC products. This represents only about 8% of direct goods purchases. In comparing the SABRC and EPP programs and the focus of the respective departments, DGS works primarily with State agencies on government purchases and has a broad scope with respect to covering multiple environmental attributes in its EPP program. Additionally, DGS has multiple statutory sustainability priorities besides the environment, including socio-economic activities to encourage small business and disabled veteran business enterprises. Meanwhile, CalRecycle and ARB activities cover a wide range of products and purchasers (both government and non-government entities), but they have a more narrow focus on achieving GHG and waste reduction goals (rather than a detailed focus on all environmental and socio-economic considerations).

Purchasing Data

The information in this document is derived from two sources of State procurement data: the State Contract & Procurement Registration System (SCPRS) and the SABRC reports. Each has different emphases and limitations. SCPRS covers all purchases of goods and services over $5,000, while SABRC focuses on purchases of recycled-content products in 11 broad product categories.

Analysis of SCPRS Data

The State Contract & Procurement Registration System (SCPRS) is maintained by DGS and tracks goods and services over $5,000 procured by the State of California. As shown in Table 1, State procurement of goods and services totaled approximately $14.3 billion in 2012. Of this, $1.5 billion of these purchases are directly for purchase of goods.

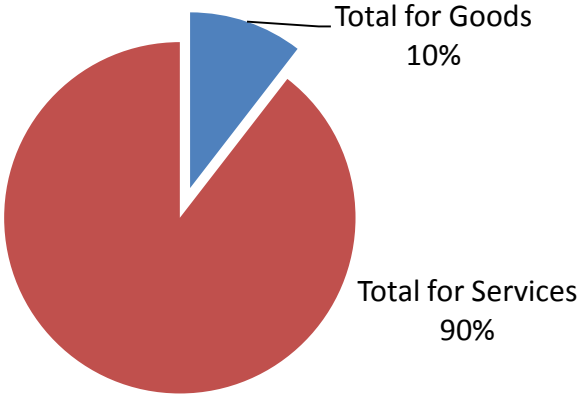
However, as explained below, an unknown amount of goods is also purchased as part of overall services purchases.

Table 1. State Procurement of Goods and Services (2012)

Procurement Type	Unit Total
IT Goods Total	$374,592,000
IT Services Total	$1,188,124,000
NON-IT Goods Total	$1,119,869,000
NON-IT Services Total	$11,580,335,000
Grand Total	**$14,262,920,000**
Total for Goods (IT and non-IT)	$1,494,461,000
Total for Services (IT and non-IT)	$12,768,459,000

The "IT Goods" and "NON-IT Goods" categories include goods or commodities such as computers, electronics, office supplies, highway construction and maintenance material, building materials, landscaping maintenance supplies, food, vehicles, vehicle parts and supplies, and numerous other type of goods. The "IT-Services" and "NON-IT Services" categories include expenditures associated with services such as temporary labor, equipment maintenance contracts, and goods purchased within those service contracts. Depending on the purchasing agency, the amount of a service contract that can be used to purchase goods may vary.

Figure 2. Expenditures for Goods and Services (2012)



As shown in Figure 2, about 10% of the expenditures in 2012 were used to purchase goods. However, that percentage is likely much greater since goods purchases are

also included in the services expenditures which account for about 90% of the total expenditures in 2012. Agencies with delegated and/or statutory purchasing authority may purchase goods and services independently, including through service contracts. Service contracts can include up to 40% being spent on goods (unless the agency has its own delegation, such as Caltrans, in which case the 40% maximum does not apply).

NON-IT Services categories comprise the largest percentage of annual expenditures and, given that 40% or more of these expenditures could potentially be used to purchase goods, it is a category that deserves additional investigation to determine if there are opportunities for increasing the purchases of environmentally preferable and PCRC products.[34] In addition, major services areas such as Health Care Services and Education and Training Services are potential targets for further investigation because together they account for almost $8 billion in total purchasing.

SCPRS also provides information regarding the purchases by individual State agencies. The SCPRS data reported for 2012 indicates that State agencies with the highest purchases of goods and services are as follows:

- Department of Public Health $4.3 billion
- Department of Social Services $1.9 billion
- Caltrans $1 billion
- Correctional Health Care Services $687 million
- Department of Water Resources $650 million
- Department of Corrections and Rehabilitation $601 million
- Employment Development Department $558 million
- State Hospitals $553 million
- Department of Health Care Services $504 million
- Energy Commission $285 million

Analysis of SABRC Data

The SABRC is a joint effort between CalRecycle and DGS to implement State law requiring State agencies and the Legislature to purchase post-consumer recycled content products. SABRC includes purchasing and reporting requirements for 11 broad recycled-content product categories. For each of these products, minimum recycled content specifications have been established. It should be noted that there are major categories of products included in SCPRS that are not under the scope of the SABRC program (e.g., lumber, textiles, and concrete). This is reflected in a comparison between the total SABRC expenditures and those reported to SCPRS. As a result, total SABRC reporting of $185 million is dwarfed by data in SCPRS, indicating that goods purchases alone are about $1.5 billion. However, within individual categories such as “printing and writing papers”, SABRC reports higher numbers. This may be due to

[34] Available data does not allow delineation of how much of service contract funding is spent on goods. It is difficult to identify areas with the most expenditure on goods, as service categories appear to cover a wide array of activities (medical supplies, training, delivery, maintenance, furnishings, food services, foster care services, public safety, etc.).

several factors: inconsistencies in choosing the category in which to report purchases by staff entering the data, different category definitions between the two data systems, and the limitation that SCPRS reporting is voluntary under $5,000 (e.g., a large portion of paper procurement may be under this level).

Across the 11 products under SABRC, there is a wide range of compliance with the SABRC specifications.[35] For some categories, the percent of purchases compliant with the SABRC specifications is very high, over 85% for compost, co-compost and mulch, and metal products. For others, there is room for improvement. For example, only 7% of the reported antifreeze purchases are compliant with the SABRC specifications. Improvement in the program can also be made by modifying the recycled content requirements. An example of where this could provide additional benefits for printing and writing paper is provided in a case study in Appendix 2. Additional categories such as concrete, carpet, and lumber could be incorporated into the program. Finally, products that are purchased through service contracts or through non-Statewide contracts could be better incorporated into the SABRC program. Currently, it appears that SABRC accounts for less than 8% of State product purchases.

Table 2: Total SABRC reported purchases, Fiscal Year 2011-2012

Product Category	Total SABRC Reportable Dollars	Total SABRC Compliant Dollars	% SABRC Compliant Spending	No. of Agencies Reporting in each Category
Antifreeze	239,900	18,255	7%	37
Compost, Co-compost Mulch	1,930,803	1,896,039	98%	39
Glass Products	1,557,086	929,060	59%	76
Lubricating Oils	1,605,676	743,859	46%	77
Metal Products	96,413,159	83,289,646	86%	168
Paint	935,361	113,949	12%	89
Paper Products	19,264,038	11,092,601	57%	192
Plastic Products	22,075,743	12,037,875	54%	190
Printing and Writing Paper	29,384,140	17,226,378	58%	201
Tire-derived Products	1,774,310	1,393,552	78%	41
Tires	9,976,596	1,157,368	11%	77
Totals	**185,156,812**	**129,898,582**	**70%**	**201**

[35] Reporting agencies indicate that recycled antifreeze is hard to find and agencies cannot control the choice of products sold or used by vendors with which they contract. Also, in some cases, state cars are sold before antifreeze needs to be changed out as many manufacturers recommend 100,000 miles for antifreeze change-out.

Related Procurement Activities

There are several activities underway to improve upon the SABRC and EPP programs, reduce GHG emissions, or improve the tracking of purchases. These are discussed below.

Many State agencies have delegated purchasing authority, under which they have the discretion to purchase on their own behalf without using DGS Statewide contracts developed under the EPP program. DGS is considering implementation of a new procedure that includes SABRC compliance checks during the annual certification and renewal of each agency's delegated authority. Based on informal discussions to date, this could result in a modification to DGS's annual determination regarding State agencies' delegated purchasing authority, whereby DGS would inform a non-compliant agency that it needs to meet the minimum SABRC requirements. This could also lead to a requirement of additional assistance and training for that agency.

CalRecycle also has been working to incorporate SABRC categories and reporting into the Financial Information System for California (FI$Cal), which is intended to enable the State of California to combine accounting, budgeting, cash management, and procurement operations into a single financial management system. In March 2013, the FI$Cal team notified CalRecycle that SABRC requirements will be included within the FI$Cal system, of which the first phase is scheduled for testing in 2014. The FI$Cal team also approved the inclusion of 7 product categories (carpet, vehicles, mulch, open panel office systems, janitorial paper supplies, IT equipment, and printer/duplication cartridges) in addition to the 11 existing SABRC product categories.

DGS has taken active steps related to vehicle procurement. It implemented Executive Order S-14-09, which required all State agencies and departments (agencies) to reduce their motor vehicle fleets by 15 percent and reduce take home vehicle storage permits by 20 percent. As of the July 2010 Report[36], agencies subject to the Executive Order have reduced their fleets by 23 percent and reduced greenhouse gases by 3,744 to 20,577 tons per year; reduced fuel consumption by over 10 percent; and increased procurement of alternative fuels. In addition, the DGS Office of Fleet and Asset Management created a Petroleum Reduction Advisory Committee to develop a plan outlined in AB 236 (Chapter 593, Statutes of 2007). DGS has compiled resulting fuel data in its 2012 Progress Report for Reducing or Displacing the Consumption of Petroleum Products by the State Fleet.[37] Another DGS program that results in reduced GHG through energy savings is the DGS Green Building Action Plan required by Executive Order B-18-12.

DGS's Procurement Division also offers frequent EPP training for State procurement officials through its California Procurement and Contracting Academy (Cal-PCA). In collaboration with CalRecycle, annual revisions to the Basic Acquisition training course

[36] http://www.documents.dgs.ca.gov/ofa/FleetReduction/FleetReduction-FinalReport-July2010.pdf

[37] http://www.documents.dgs.ca.gov/ofa/ab236/PetroleumReductionStatusReport(RevMay2012).pdf

incorporate SABRC updates. DGS's longer-term plan is to convert the course and deliver EPP training as a webinar to increase attendance by State procurement staff.

In 2013, DGS re-convened the previous EPP Taskforce (which functioned from 2002 to 2009) in the form of the Performance and Environmental Standards (PES) workgroup in order to assist procurement professionals in improving policies and practices in order to achieve best value procurements. The workgroup consists of a majority of the State's environmental agencies and other State agencies with significant procurement expenditures, including those with delegated authority. The group will help ensure that EPP initiatives are consistent with the efforts and initiatives of the other environmental agencies through the State. Key goals of the PES are to:

- Provide guidance and assist procurement professionals in achieving best value, thereby reducing risk to procurement audits.
- Reduce risk in the procurement process: cost, processing time and protests.
- Create a transparent process and central clearing house for standards development.
- Increase the State's purchase of products lowering the State's carbon footprint.
- Provide a means of coordination with other State and federal agencies programs and work groups involving regulatory, research, and data collection efforts.
- Introduce policy in the State Contracting Manual.

III. CHALLENGES

Clearly, there are additional opportunities to increase the procurement of environmentally preferable and post-consumer recycled content goods. Increasing compliance in SABRC product categories that have low compliance rates, adding new SABRC product categories, increasing the recycled content specifications, and targeting consumption of goods that are reported under the IT-Services category are a few examples of actions that can be undertaken that will help further progress in meeting the State's GHG emission reduction and increased recycling goals. However, there are several challenges/issues that need to be addressed to facilitate implementation of these opportunities which are briefly described below.

1. **Data Gaps:** There are several issues with how data is reported and recorded which makes it difficult to track the volumes and types of goods purchases. For example, product purchases under construction and service contracts can be aggregated, not allowing for tracking of individual products; service contracts are not required to delineate monies expended on goods; little information is available on what is purchased through delegated authority versus through a DGS-developed State contract; State contractors do not necessarily purchase, or report on purchases of recycled-content goods; and the product categories in SCPRS generally do not distinguish the materials composition of products and/or their packaging, which makes it more difficult to determine potential GHG emissions associated with the categories.

2. **SABRC Statutory Provisions:** SABRC does not cover all products with recycling (AB 341) or GHG (AB 32) implications (such as lumber, textiles, carpet, and concrete), the minimum PCRC percentages are outdated in some categories, and some categories include mixed materials that cause difficulties in reporting. Community Colleges and the University of California system are not included.[38] In addition, there is no enforcement mechanism for non-compliance.
3. **State Contractors**: State contractors and their subcontractors, including those on service contracts, are required to use recycled products to the maximum extent economically feasible in the performance of the contract work. According to General Contract Agreements, State contractors are required to report[39] on the recycled content of goods offered or sold to the State. However, State contractors are not required to meet the same purchasing requirements as are State agencies (e.g., SABRC). These requirements are generally not implemented, there is no clear reporting mechanism, and it is unclear if the requirement applies to subcontractors.
   - DGS Procurement Division develops specifications/contracts for products having a Statewide contract and the Green Buying Guide hosts information on Statewide contracts that have incorporated EPP. Additionally, there are many other products that are used in State facilities and are purchased through service providers/contracts. For example, paint, carpet, and many building materials are not purchased off of statewide contracts, but rather are purchased through individual construction-related service contracts via DGS-Real Estate Services Division, other DGS entities, and delegated agencies. Building contractors cannot purchase off statewide contracts so these types of purchases are not directly impacted by the EPP statewide contracts and these contractors may or may not be including language in their solicitations that is consistent with EPP.
4. **Delegated Authority:** As noted above, many State agencies have delegated purchasing authority, under which they have the discretion to purchase from a wide variety of purchasing mechanisms. While State agencies are required to adhere to SABRC requirements regardless of the procurement mechanism used or who conducts the purchase, it is not clear if these delegated decisions adhere to SABRC requirements, including reporting, and there is no enforcement mechanism for non-compliance with the SABRC requirements.
5. **Reporting Issues:** There is potentially under-reporting of purchases in SABRC and different reporting requirements between the SABRC and the SCPRS databases. It is not clear whether all agencies purchasing off of State contracts provide that data to both SCPRS and SABRC. SCPRS has only one data field to list the United Nations Standard Products and Services Code (UNSPSC) code, which is used to identify specific products and services, so when an order contains many products, the UNSPSC code is more difficult to decipher and include in the analysis (this covers about $850 million of purchases). There is also a lack of reporting requirements (e.g., see "State Contractors" above).
6. **Verification of PCRC:** There is no system to track that all State agencies are requiring suppliers to verify the PCRC of their products and there is not an enforceable requirement on suppliers to provide the verification for their products.

[38] Local jurisdictions also are not required to meet the same PCRC/EPP purchasing requirements.

[39] Excluding interagency agreements

7. **Lack of Product Information:** Manufacturers and suppliers are not consistently required to disclose their products' environmental information so that specification writers, contract managers, and buyers would have readily available access to basic information on environmental performance.
8. **Cost of Recycled Content Products:** In some cases, recycled-content products may cost more than virgin and, in these cases, many employees are unaware that the recycled content products may still be purchased. Statute directs State agencies and the Legislature to purchase fewer of those more costly products or apply cost savings, if any, gained from buying other recycled products towards the purchase of those more costly products (Public Resources Code Sections 12217 and 12305.5.)
9. **Need for Additional Education:** There continues to be a need for education that reaches all State agency purchasing officials, but it also needs to go beyond and reach staff within agencies that do the ordering of materials.
10. **Emission Reduction Factors:** There is a need to develop additional emission reduction factors for key products and product categories to assist in defining GHG emission reductions associated with procurement of EPP and PCRC products.
11. **Competing Priorities:** This paper focuses on waste and GHG reductions opportunities that could be achieved through State purchasing decisions made by all State agencies and their contractors. ARB and CalRecycle acknowledge that other statutory and policy requirements regarding State purchasing may sometimes conflict or compete with these waste and GHG reduction goals, particularly with respect to environmentally preferable purchasing contracts generated by DGS. At this time, it is unclear how great an impact competing requirements might have on State purchasing to help achieve the State's waste and GHG reduction goals.

IV. POTENTIAL OPPORTUNITIES FOR SUPPORTING WASTE REDUCTION AND ACHIEVING GREENHOUSE GAS EMISSIONS REDUCTIONS THROUGH STATE PROCUREMENT

Based on the analysis of the SCPRS and SABRC data and the large volume of goods purchased for State operations, there is the potential to further leverage procurement decisions to support the State's broader waste reduction and climate change goals by increasing the procurement of environmentally preferable and post-consumer recycled content goods. However, without improved data on goods purchasing it is difficult to pinpoint what goods to target and what is the best mechanism to realize the needed changes in procurement practices. Below, we outline actions and a process for identifying a feasible path forward to capture potential opportunities for waste reduction and GHG emission reductions. While there are multiple factors and requirements that need to be addressed in purchasing decisions and these cannot be ignored, the focus in the discussion below is limited to potential waste and GHG reductions.

- **Improve Goods Procurement Data Collection and Reporting**

Data gaps need to be addressed through improvements in current reporting of goods purchased such that individual product types and amounts can be tracked by purchasing agency. Data is needed for goods purchased under delegated authority and within service contracts. This may require statutory or regulatory actions.

- **Identify High Volume Product (Goods) Categories and Associated State Agencies/Contractors/Subcontractors with Greatest Potential for Waste/GHG Reductions**

Data analysis needs to be completed once a complete data set is available. There are hundreds of different product types purchased by State agencies or indirectly through contractors and subcontractors, and it is important to determine which products have the most potential for waste reduction and GHG emission reductions so those products and their purchasers can be targeted for further evaluation. As an initial prioritization of products, agencies, or processes with opportunities for waste reduction and GHG emission reductions, SCPRS data was used as a preliminary step to identify potential future focus areas. A total of 17 products were identified and categorized into two tiers. Ten products were identified as Tier 1 categories and are considered to be a higher priority based on synergism with other waste reduction goals, the contribution to waste disposal in California, and the availability of options for reducing waste and GHG emissions. Seven products were categorized as Tier 2 and initially given lower priority than the Tier 1 products. Table 3 lists the Tier 1 and 2 products.

Table 3: Priority Products for Evaluation with Potential for Waste and GHG Reductions

Tier 1 Product Categories		Tier 2 Product Categories
Food	Plastic Food Containers	Rock, Soil and Fines
Lumber (dimensional, engineered, pallets, plywood)	Durable and Miscellaneous Plastic Items	Mattresses
Concrete and Asphalt	Textiles (towels, sheets, uniforms, etc.)	Paper Towels, Toilet Paper
Paint		Computers, Printers, Monitors
Carpet		Batteries
Copy Paper		Photovoltaic Products
Compost and Mulch		Lubricating Oils

Appendix *1: State Purchases: AB32 Potential Opportunities for Waste Reduction and Greenhouse Gas Emissions Reductions*—is an initial attempt to provide an overview of State purchasing of Tier 1 and 2 materials. Appendix 1, summarizing the Tier 1 and 2 product categories purchased by State agencies, explains why a particular product category is important from a waste/GHG perspective, identifies the amount spent on products and services for a representative year (2012), and shows the agencies making most of the purchases in the category. The information presented in Appendix 1 was developed using publically available information from the SABRC and SCPRS databases. The data presented in the Appendix 1 table is incomplete, however does provide a starting point to help facilitate further discussions on products where procurement practices and the end-of-life management of products may offer opportunities for increasing recycling and reducing GHG emissions. This information should be considered to be a "living document" and will be refined as improved data becomes available. The Appendix 1 summary table also includes some smaller agencies that are not necessarily major purchasing entities, but may purchase significant amounts of a products identified in Tier 1 or Tier 2. These smaller entities include: California Conservation Corp, California Highway Patrol, CalRecycle, Department of Forestry and Fire Protection, Department of Mental Health, Department of Parks and Recreation, Department of Fish and Game, and the Military Department. An example of this is the Department of Parks and Recreation purchasing of compost and mulch. While the dollar amount of the purchases is relatively small, they are the second largest purchaser of these materials.

- **Legislative and/or regulatory changes may be needed.**

Legislation and/or regulations may be needed in order to affect identified reporting improvements and purchasing requirements.

- **Develop Waste and GHG Emission Reduction Factors**

Having the tools to quantify waste and GHG emission reductions associated with changes in procurement practices is critical to prioritizing actions and tracking progress in achieving California's overall waste and GHG reduction goals. For products targeted for evaluation, lifecycle GHG emission reduction factors and waste reduction factors will need to be developed or updated. ARB, CalRecycle and DGS need to work together to prioritize where development of waste and emission reduction factors is most critical.

- **Identify and Implement Effective Approaches to Achieve Waste/GHG Reductions for Targeted Products**

For each targeted product, there is a need to identify potential options for adjusting or modifying procurement practices to enhance waste and GHG reductions goals. Options could include educational outreach/incentive programs, steps to improve compliance for products already having SABRC specifications, creating SABRC requirements and supporting specifications for new products, improving SABRC and SCPRS database

interaction, increasing the recycled content specifications, development of mandates to ensure purchases by State agencies with delegated purchasing authority and those products purchased under service contract adhere to SABRC requirements.

Appendix C - Focus Group Working Papers

APPENDIX 1. State Purchases: AB32 Potential Opportunities for Waste Reduction and Greenhouse Gas Emissions Reductions

This table is intended to help facilitate further discussion among ARB/CalRecycle/DGS and others on commodities where procurement practices and the end of life management of products may offer opportunities for waste and GHG emission reductions. It lists various commodities typically purchased by the State, explains why a particular product category is important from a waste/GHG perspective, identifies the amount spent on products and services for a representative year (2012), and shows the agencies doing the most purchasing. The table also flags gaps in our knowledge that are represented by missing information on total spent. As a first step to prioritize the list of commodities, commodities are separated into two tiers. Tier 1 commodities are considered to be a higher priority based on synergism with other waste reduction goals, the contribution to waste disposal in California, and the availability of options for reducing waste and GHG emissions.

Purchased commodities or services	Why Important?	Total Spent (2012)[40]	Key Purchasing Agencies					
		SCPRS data	Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
Tier 1								
Food	• Food waste is 15.5% of disposal (highest category) • Generates methane • USEPA has identified several food categories as having high material impacts and GHG impacts	>$118 million		>$100 million Purchases through DGS/PD contracts				Other top food purchasers are: Dept of Forestry and Fire Protection (est $6 million), Dept of State Hospitals (est $4 million) and Dept of Mental Health (est $3.5 million).
Lumber	• Clean dimensional lumber,	>$3 million[41]	>$2.5 million	>130K	Indirect purchases			

[40] Overall, the data reported will be less than actual purchases. SCPRS reporting for purchases under $5K is optional. Additionally, the total spent presented will be under reported because of how purchases or services are coded. If the data field for the UNSPSC code contained multiple entries some of these line items are not included in the analysis because it was not possible to match a code with a commodity.

[41] Also purchased through construction projects, which may not be accounted for in this analysis.

Purchased commodities or services	Why Important?	Total Spent (2012)[40] SCPRS data	Key Purchasing Agencies					
			Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
(dimensional, engineered, pallets, plywood)	engineered lumber, and wood pallets are each > 2.5% of disposal • Generates methane • Forest carbon sequestration is reduced when harvesting trees to produce wood products, resulting in significant GHG impact				through construction contracts			
Concrete and Asphalt	• High GHG impacts in production of cement that is used in concrete. • Waste concrete composes greater than 1% of CA disposal • On USEPA list of having high materials and GHG impacts • Rubberized asphalt concrete uses waste tires and is an road surface alternative with lower GHG	>$4.3 million for concrete; >$33 million for asphalt[42]	Purchases millions of dollars of construction services ($2,854 million in 2009-June 2011) for transportation infrastructure (not including federal funds which were significantly more)	Purchases millions of dollars of construction services (planning for $2,811 million in over 300 projects)	(K-12 education follows transportation in terms of construction dollars – overseen by the Div of the State Architect in DGS)		Purchases millions of dollars of construction services ($63 million in 2010/ 2011) for levees and State water system.	CalRecycle >$1.8 million of asphalt
Paint	• Paint is a HHW, banned from disposal • SABRC category (not compliant with targets) • Certified product is available with post-consumer recycled content that meets performance standards of virgin paint • Statewide collection program recently started that will generate more recycled paint • Recycled paint provides GHG reduction over virgin paint	> $ 3 million[43]	>$2.5 million		Indirect purchases through construction contracts		>$100K	
Carpet	• Discarded carpet comprises 3.2% of CA disposal • Use of recycled plastics from carpet	>$800K[44]	>$350K		Indirect purchases through construction			Employme nt Developme

[42] Also purchased through construction projects, which may not be accounted for in this analysis.

[43] Also purchased through $160 million spent on building construction.

[44] Also purchased through $160 million spent on building construction.

Purchased commodities or services	Why Important?	Total Spent (2012)[40] SCPRS data	Key Purchasing Agencies					
			Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
	into new products significantly reduces GHG				contracts			nt Dept >$300K
Copy paper	• White ledger paper and office paper are 1.9% of CA disposal. • Paper with higher post-consumer recycled content (PCRC) that offers additional GHG savings. • Paper is widely used in State government facilities.	>$5.5 million copier paper[45] >$65 million various types of paper		>$1 million Purchases the highest quantity via Statewide contract				Employment Development Dept (EDD) >$1.3 million, CHP >$300K, DMV >$300K
Compost and Mulch	• Commonly composted items like leaves and grass, and pruning and trimmings comprise 6.5 % of disposal in CA. Also food waste, much of which is compostable, comprises 15.5% of disposal in CA. • Compost reduces GHG through avoided landfill methane emissions and improved soil quality that reduces water consumption and use of herbicides/pesticides/fertilizers. • Opportunities exist to purchase landscaping plants that generate less debris and support markets for compost.	>$10 million	>$10 million Purchases the most mulch/compost; large purchases likely within construction contracts		Large purchases likely within construction contracts	>$125K		>$90K California Conservation Corp
Plastic food containers	• Estimated to comprise more than 1% of disposal in CA and is associated with food purchases, which are very significant State purchases. • When plastic packaging is recycled or food has a longer shelf-life, there are GHG reductions.							
Durable and	• Comprise 1.9% of disposal in CA.		80% of total	80% of total	Large purchases			

[45] This is likely lower than that actual amount. SCPRS only requires data on purchases over $5K. Paper purchases may fall below this amount and not be included. Or they may be included with other office supplies and not accounted for in this analysis.

Purchased commodities or services	Why Important?	Total Spent (2012)[40] SCPRS data	Key Purchasing Agencies					
			Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
misc. plastic Items	• Recycled plastic products provide reduction in GHG emissions and close the loop that makes recycling viable. Some recycled plastic products may replace a material, such as wood, and provide GHG reduction and close a loop for plastics recycling. • If not recyclable (unable to be disassembled, lack of labeling that identifies resins), standards could be created to make recycling more feasible.		spend for plastic is attributed to plastic bags between 2009-2013 per eSCPRS report. Caltrans purchasing 15% of the bags.	spend for plastic is attributed to plastic bags between 2009-2013 per eSCPRS report. CDCR purchases 21% of the bags.	likely within construction contracts			
Textiles (towels, sheets, uniforms, etc.)	• Textiles are 2.2% of disposal in CA. • Towels, linens, uniforms, blankets, safety apparel, etc. are purchased by the State in significant amounts. More durable textiles and recycling these materials can reduce GHG emissions.	>$20 million	>$ 5 million	>$ 10 million				> $2.5 million Military Dept
Tier 2								
Rock, soil and fines	• Comprises 3.2% of CA disposal. • The extraction of these materials uses a lot of energy (GHG) • Alternatives materials exist that reduce the need for virgin materials	>$2.5 million[46]	>$1.8 million Caltrans likely purchases under A&E contracts as well		Large purchases likely within construction contracts		DWR likely purchases under A&E contracts	
Mattresses	• Mattresses are a portion of bulky items that comprise 3.5% of disposal. • 85% of mattresses (by weight) can be readily reprocessed into useful secondary resources. • Material recycling is estimated to offset 45% of GHG emissions from production and landfill of mattresses and box springs. • Recycling is currently low.	>$1.7 million		>$1.3 million				>$100K Dept of State Hospitals, >$100K Dept of Mental Health

[46] Many purchases are likely made through construction related contracts and are not accounted for in the totals.

Purchased commodities or services	Why Important?	Total Spent (2012)[40] SCPRS data	Key Purchasing Agencies					
			Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
Paper towels, toilet paper	• Misc. paper is more than 2.8% of CA disposal (there isn't a category for janitorial papers). • Janitorial papers are very suitable for high PCRC (well above the 30% specified in the SABRC category for all paper products). • Currently there doesn't appear to be a State contract or standards in place for these products to help ensure they are purchased with high PCRC.	>$6 million		>$3.6 million	$1 million (DGS)			>$350K State Hospitals
Computers, printers, monitors	• Computers, printers, monitors are a very significant category of expenditure by State agencies. • These materials are banned from landfill disposal due to their toxic components. • As a large purchaser, the State is able to foster advancements in sustainability. Use of recycled content materials reduces GHG emissions and recycling these products saves rare earth metals.	>$62 million	>$15 million	>$3.2 million			>$3.2 million	>$5.4 million CHP >$4.2 million Correction al Health Care Services
Batteries	• Batteries are banned from landfill disposal in CA, but are still disposed. • More products (e.g., bathroom fixtures, power tools, small electrical devices) use batteries so their use increases. • GHG emissions can be reduced through the selection of longer lasting batteries. There are a few eco-labels that cover batteries (e.g. Nordic Swan).	>$1.6 million[47]	>$400K	>$500K	>$86K		>$82K	>$164,816 Correction al Health Care Services >$62K CHP
Photovoltaic products	• Many State facilities are installing • PVs have hazardous components and are banned from landfill	>$1.3 million	>$400K	>$130K		>$300K		>$150K State Hospitals

[47] Many batteries are purchased with other supplies and not included in analysis.

Purchased commodities or services	Why Important?	Total Spent (2012)[40] SCPRS data	Key Purchasing Agencies					
			Cal-Trans	CDCR	DGS	Parks & Rec	Water Resources	Other
	disposal (a type of electronic waste). • Policies can reduce the future burden of managing these products. • Similar to other electronic products, recycled content and recyclable products will reduce GHG emissions and provide for the capture of rare earth metals.							>$115 Fish and Game
Lubricating Oils	• Recycled used motor oil is a SABRC product category with non-compliance participation rates (46%). • Purchasing recycled used motor oil supports recycling and has lower GHG emissions as compared to virgin motor oil. • 29 % of total spend for lubricating oil products are attributed to fuel oil, 24% pump lubricating oils, 16% engine oil and less than 3% synthetic oils between 2009-2013.	>$380K[48]	Caltrans purchases <2% of engine oil	>$95K			>$100K	>$128K CHP

[48] Lubricating oils are probably part of maintenance services and do not appear in this value. The SABRC programs indicate $1.6 million spent on this category.

APPENDIX 2. CASE STUDY – CURRENT PRINTING AND WRITING PAPER PROCUREMENT AND GHG EMISSIONS

The following case study, using printing and writing paper as one example, is provided to illustrate how a change in the State's procurement practices can result in GHG emission reductions and increased market demand for recycled content materials. Although this case study is focused on printing and writing paper procurement for illustrative purposes, CalRecycle's procurement goals are not limited to this particular product type, and CalRecycle is committed to promoting the procurement of higher PCRC in other products, including all of the product types in the SABRC program.

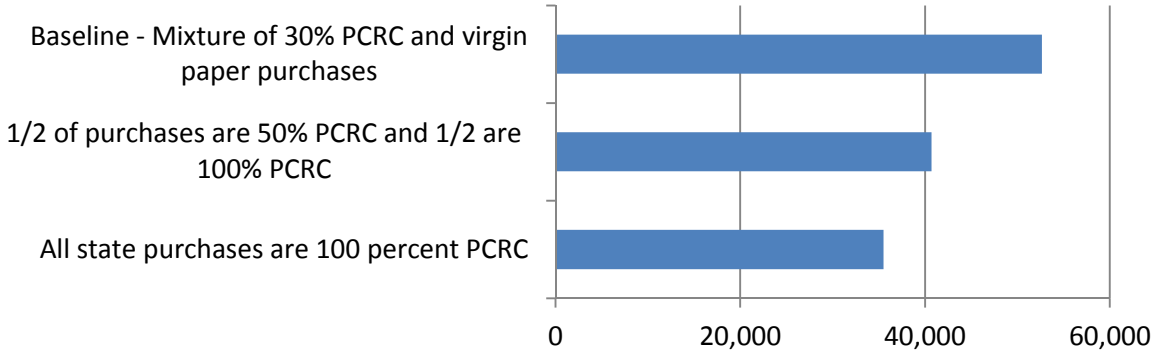
According to SABRC, the State spent $29 million in 2011 on printing and writing paper procurement, of which only $17 million (approximately 366,750 cases) was spent on SABRC-compliant paper (at least 30% post-consumer recycled content (PCRC), see Table 3)[49]. If the State increases procurement of printing and writing paper that has a higher percentage of PCRC, it will realize a reduction in the carbon footprint of State's paper procurement, as shown in Chart 3.

Table 3. SABRC Data for Printing and Writing Paper, from fiscal year 2011-2012

Total SABRC Reportable Dollars (Million $)	Total SABRC Compliant[1] Dollars (Million $)	Non-Compliant[1] Expenditures Dollars (Million $)
29.4	17.2	12.2

1. * "Compliant" refers to the paper having at least 30% post-consumer recycled content (PCRC)

Chart 3 - State Writing and Printing Paper Purchases, Metric Tons CO2 Equivalent (2011)



[49] Once FI$Cal is operating, state agencies will have increased abilities to report specific PCRC levels which should result in improved reporting and enable better estimates of GHG emissions from the State's procurement.

Business as Usual Paper Procurement GHG Emissions

Based on the 2011 SABRC data, 9,169 tons of noncompliant paper and 12,991 tons of compliant, minimum 30% PCRC, paper was purchased. The GHG emissions associated with the 2011 paper procurement are approximately 52,646 MTCO2e.

Potential GHG Emission Reductions from changes in Paper Procurement

Scenario 1: If half of all State agencies' copy paper purchases contain 50% PCRC and half of the purchases contain 100% PCRC, the total estimated GHG emissions would be 40,709 MTCO2e. This represents a 23% reduction in GHG emissions (11,937 MTCO2e) from the emissions associated with the State's paper procurement in 2011, and would result in market demand for approximately 12,000 tons of recycled feedstock. This is equivalent to 1,360,766 gallons of gasoline saved[50]. This scenario, which would increase market demand for recycled content fiber, illustrates how a change in the State's procurement practices can result in GHG emission reductions.

Scenario 2: If all State agencies copy paper purchases contain 100% PCRC, the total estimated GHG emissions would be 35,512 MTCO2e. This represents a 33% reduction in GHG emissions (17,133 MTCO2e) from the emissions associated with the State's paper procurement in 2011, and would result in market demand for approximately 18,000 tons of recycled feedstock. . This is equivalent to 1,953,187 gallons of gasoline saved[51]. This scenario, which also would increase market demand for recycled content fiber, illustrates how a change in the State's copy paper procurement practices can result in GHG emission reductions.

[50] http://www.arb.ca.gov/cc/factsheets/1mmtconversion.pdf

[51] http://www.arb.ca.gov/cc/factsheets/1mmtconversion.pdf

Table 4 contains a list of agencies or departments that have the greatest opportunity to reduce GHG emissions from paper procurement based on the volume of non-compliant paper procurement.

Table 4. Top 15 State entities with the most non-compliant expenditures (printing and writing paper, fiscal year 2011-2012)

Department	Total SABRC Reportable Dollars (Million $)	Total SABRC Compliant Dollars (Million $)	% SABRC Compliant Spending	Non-compliant expenditures (e.g., virgin paper) (Million $)
California State University Chancellor's Office	4.0	1.8	45%	2.2
Department of General Services	7.6	6.0	79%	1.6
Department of Justice	2.5	1.3	50%	1.3
State Controller's Office	2.0	0.8	42%	1.1
California Medical Facility	0.9	0.1	10%	0.8
California Highway Patrol	0.8	0.1	13%	0.7
Prison Industry Authority	0.6	0.05	8%	0.6
Department of Industrial Relations	1.3	0.8	61%	0.5
State Board of Equalization	0.6	0.3	47%	0.3
California State Library	0.3	0.007	2%	0.3
Valley State Prison for Women	0.3	0.1	34%	0.2
California Department of Transportation	0.7	0.5	75%	0.2
California Department of Consumer Affairs	0.3	0.2	58%	0.1
California Public Employees Retirement System	0.4	0.3	66%	0.1
Department of Motor Vehicles	0.8	0.7	85%	0.1

Another factor to take into consideration when identifying opportunities is where the largest amounts of goods or commodities are purchased. As noted earlier, total expenditures for a given commodity are not readily extractable from the publically available data. However, as a surrogate, one can assume that if an agency has high expenditures, there is a good possibility that a portion of monies is expended on goods. Below is a list of the top 15 State agencies purchasing copy paper based on the SCPRS report for 2012. The total among all agencies was $5.7 million. (SCPRS reporting is optional for purchases less than $5,000 so it doesn't include all purchases or purchases of copy paper captured in other categories). Differences appear

which could be attributed to different years, different papers being included in categories, and missing purchasing information.

Table 5. Top Purchasers of Copy Paper, 2012 (SCPRS)

Department	Total Spent Million $
Employment Development Department	$1.3
Department of Corrections and Rehabilitation	$1.0
California Highway Patrol	$0.4
Department of Motor Vehicles	$0.3
Department of Justice	$0.3
Department of Transportation (Caltrans)	$0.2
Department of Rehabilitation	$0.2
Franchise Tax Board	$0.2
Department of Industrial Relations	$0.2
Board of Equalization	$0.2
Department of Public Health	$0.2
Air Resources Board	$0.1

Paper Purchases Overall

The total spent in the paper category in 2012 was about $65 million among 42 agencies. Table 6 shows the agencies that spent the most on a broad range of papers. Paper-types include: copy paper, forms, books, and janitorial supplies. It does not include printing orders and newspaper ads, which are about $19 million.

Table 6. Top Purchasers of Papers, 2012 (SCPRS)

Department	Total Spent Million $
Department of Social Services	$35.9
Department of General Services	$10.1
Department of Corrections and Rehabilitation	$5.6
Employment Development Department	$1.6
California Victim Compensation and Government Claims Board	$1.5
Correctional Health Care Services, formally (Prison Health Care Services)	$1.2
California Highway Patrol	$1.0
Department of Motor Vehicles	$0.8
Franchise Tax Board	$0.8
Department of Transportation(Caltrans)	$0.7

Addressing Concerns with Purchasing PCRC Paper

One concern with purchasing high PCRC paper is the issue of cost. However, by purchasing through the State contract, the cost issue can be minimized. For example, State contract offers two levels of PCRC paper: Type I (30 - 50% PCRC) and Type II (95 - 100% PCRC). The contract prices for Type I paper are between $26.14 and $34.27 per case. The contract prices for Type II paper are between $32.17 and $47.72 per case. There are many options available

for State agencies. For example, CalRecycle purchases 100% PCRC paper from the State contract for $37.63 per case.

Although high PCRC paper products may be more costly than virgin products in some cases, there are also examples demonstrating that purchasing paper with high PCRC can be more cost-effective. In cases where high PCRC paper products are more expensive than similar virgin paper products, the State still encourages buying recycled. CA Public Contract Code 12217(c) states that, “If a recycled product, as defined in subdivision (h) of Section 12200, costs more than the same product made with virgin material, the State agency shall, if feasible, purchase fewer of those more costly products or apply the cost savings, if any, gained from buying other recycled products towards the purchase of those more costly products to meet the solid waste diversion goals of Section 41780.” By purchasing high PCRC paper products, State agencies have the opportunity to save money while also reducing GHG emissions.

Another concern with purchasing paper with high PCRC is the transportation of recovered paper to mills. While it is important to minimize transportation, both upstream and downstream, in all aspects of the paper product industry, literature suggests that Life Cycle Analysis (LCA) studies show that even after the energy used to collect, transport, and process recovered paper is accounted for, recycled paper uses much less energy overall than virgin paper (Environmental Paper Network, 2013).

BIOMASS CONVERSION
January 2014

I. INTRODUCTION

The primary focus of this paper is to identify opportunities, challenges, and potential solutions for achieving greenhouse gas (GHG) and waste reduction goals from biomass conversion facilities in California. This paper focuses primarily on biomass combustion facilities, because these plants are numerous and well established in California. However, there are a few small gasification plants, and these may be a growing option for handling biomass in California. This paper does not cover other biomass conversion processes such as anaerobic digestion or fermentation, composting, trans-esterification, or rendering. This paper also does not address waste-to-energy facilities that handle only municipal solid waste (MSW).

The sections that follow describe the biomass conversion process, feedstocks, current utilization of biomass in California, and the goals, challenges, and potential solutions for achieving additional reductions in GHG emissions and waste through the use of biomass conversion facilities. This paper is one of several papers being prepared to provide information on the role that the Waste Sector can play in meeting the goals of AB 32 and waste reduction. Companion papers discuss Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; Municipal Solid Waste Thermal Technologies; and Landfilling of Waste.

II. GENERAL DESCRIPTION OF THE BIOMASS CONVERSION PROCESSES AND FACILITIES IN CALIFORNIA

What is biomass conversion?

Biomass conversion is the process of generating energy by converting materials of recent biological origin, such as wood waste, to energy. Typically, biomass conversion is used to generate electricity for sale to the local utility. Biomass conversion can also produce marketable products such as fly ash used in cement manufacturing.

There are many benefits to the conversion of biomass, including reducing the volume of material that is landfilled, reducing forest fire hazards, generating renewable power, creating jobs, and reducing GHG emissions.

What types of biomass are available for conversion?

As mentioned above, biomass is material of recent biological origin. Included are materials such as forest and agricultural residues, but not materials like natural gas, oil, or coal. The main feedstocks for biomass conversion are forest residues, agricultural waste, and urban wood waste. Table 1 below provides an estimate of the amount each feedstock, measured in terms of the energy content in the feedstock. As shown in

Table 1, each of these biomass types is used in significant quantities. Many biomass conversion facilities use more than one of these types of biomass as a feedstock. Some plants also use a small amount of supplemental fossil fuel.

Table 1: Biomass Use in California by Energy Content (2011)[1]

Biomass Type	Energy Content (mm BTU)	Percentage
Agricultural Waste	19,000,000	28%
Forest Wood Waste	24,000,000	36%
Urban Wood Waste	24,000,000	36%
Total	67,000,000	100%

1 California Energy Commission

Agricultural waste includes orchard prunings, nut shells, fruit pits, grain straw, and other agricultural waste products. Forest wood waste typically includes undergrowth from forest thinning or logging, and sawmill waste such as bark, sawdust, shavings, and trimmings. Urban wood waste includes lumber from construction and demolition, wood, crop residues, yard and garden clippings, prunnings and nonrecyclable pulp or nonrecyclable paper. Biomass does not included recyclable pulp, recyclable paper or hazardous materials such as treated wood waste as defined by the Department of Toxic Substance Control (DTSC).

What biomass conversion systems are currently being used?

According to information from the California Biomass Collaborative, there were 22 biomass conversion (combustion) facilities in commercial operation in California in 2011(see Table 2). However, the list is subject to frequent changes due to economic conditions. More recent information indicates that there are currently about 30 operational facilities. However, we do not have emissions information for these additional facilities (as shown in Table 3 for the 2011 facilities), so we used 2011 information for this paper.

Biomass conversion facilities are located throughout the state, often near timber harvest or agricultural operations. Most of these facilities were built in the 1980s or early 1990s, after the federal Public Utilities Regulatory Policy Act (PURPA) of 1978 required utilities to purchase power provided by qualifying independent power producers at relatively attractive rates. However, California's regulatory policies were restructured in 1996, decreasing the financial incentives available for biomass conversion facilities.

Biomass conversion facilities generally accept waste deliveries by truck and then move the feedstock with conveyors. In the boiler, the feedstock is burned and combustion gases flow past water tubes where steam is produced at high pressure. The steam is used to power a turbine-driven generator that produces electrical power that is sold to the local utility. The boiler combustion designs include "stoker" type furnaces with traveling or fixed (inclined) grates, and potentially more efficient circulating fluidized bed (CFB) designs. As shown, six of the facilities use cogeneration (cogen) systems which improve overall efficiency by recovering waste heat.

Table 2: Operational Biomass Conversion Facilities in California[1]

Facility Name	Location (City)	Electrical Capacity (MW)
Blue Lake Power	Blue Lake	11
Burney Forest Power	Burney	31
Collins Pine Co. Project	Chester	12 (cogen)
Colmac	Mecca	47
Delano Energy Co., Inc.	Delano	50
Dinuba Energy Inc.	Dinuba	12
Honey Lake Power	Wendel	32
Madera Power LLC	Firebaugh	28
Mendota Biomass Power Ltd.	Mendota	25
Pacific Oroville Power Inc.	Oroville	18
Pacific Ultrapower Chinese Station	Jamestown	22
Rio Bravo Fresno	Fresno	25
Rio Bravo Rocklin	Rocklin	25
Scotia Biomass	Scotia	28 (cogen)
Sierra Power Corporation	Terra Bella	10 (cogen)
Sierra Pacific Industries (SPI) Burney	Burney	20 (cogen)
SPI Anderson	Anderson	4 (cogen)
SPI Lincoln	Lincoln	18
SPI Quincy	Quincy	25 (cogen)
Wadham	Williams	27
Wheelabrator Shasta	Anderson	50
Woodland Biomass Power Ltd.	Woodland	25
Total		**545**

1 Mayhead, Gareth, UC Berkeley, May 10, 2011

III. CURRENT STATUS OF BIOMASS CONVERSION FACILITIES IN CALIFORNIA

How much power is generated from biomass facilities in California?

According to the California Energy Commission (CEC), biomass-derived power provides about 2% of California's electricity demand, and about 19% of in-state produced renewable power. As shown in Table 2, the biomass facilities operating in 2011 had a net capacity to generate over 500 MW, with individual plants able to generate between 4 and 50 MW of electrical power. In addition to the facilities listed in Table 2, there are six idled facilities with the potential to generate an additional 90 MW (CEC PIER draft). The idled facilities are generally not operating because the price of electrical power received under their contracts with utilities is insufficient to justify operation. However, some of these plants could potentially be brought online in the future if governmental policies or other factors increase electricity rates for their power.

How much GHGs and co-pollutants are emitted from biomass conversion facilities?

The 2011 reported GHG emissions from biomass conversion are shown in Table 3. Total GHG emissions are estimated to be 6.3 million metric tons of CO2 equivalent (CO2e) emissions. There is some uncertainty in these estimates because these facilities shutdown and restart relatively frequently based on economics and other factors. Of the total emissions, nearly all (6.2 million metric tons) were biomass-based. The distinction between biomass based (biogenic) and non-biomass based (non-biogenic) emissions is important because only the emissions from combustion of non-biogenic material (such fossil fuels) are counted as GHG emissions that contribute to climate change per protocols established by the Intergovernmental Panel on Climate Change (IPCC).

Table 3: GHG Emissions from Biomass Conversion Facilities in California (2011)[1]

Facility Name	Biogenic Emissions (MT CO2e)	Non-biogenic Emissions (MT CO2e)	Total Emissions (MT CO2e)
Blue Lake Power	18,200	400	18,600
Burney Forest Power	391,100	14,100	405,200
Collins Pine Co. Project	117,200	2,000	119,200
Colmac[2]	516,100	16,200	532,300
Delano Energy Co., Inc.	630,400	3,400	633,800
Dinuba Energy Inc.	147,400	1,600	148,900
Honey Lake Power	226,100	6,400	232,500
Madera Power LLC	405,100	6,700	411,800
Mendota Biomass Power Ltd.	227,100	2,200	229,300
Pacific Oroville Power Inc.	256,800	600	257,400
Pacific Ultrapower Chinese Station	226,100	1,300	227,400
Rio Bravo Fresno	285,800	10,000	295,800
Rio Bravo Rocklin	289,700	9,300	299,000
Scotia Biomass/Eel River	265,200	5,600	270,800
Sierra Power Corporation	119,900	2,400	122,200
Sierra Pacific Industries Burney	223,300	2,800	228,100
SPI Anderson	69,900	0	69,900
SPI Lincoln	207,800	6,400	214,300
SPI Quincy	342,300	1,300	343,500
Wadham	269,900	3,700	273,600
Wheelabrator Shasta	684,100	15,000	699,100
Woodland Biomass Power Ltd.	252,400	6,400	258,800
Total	**6,171,900**	**119,800**	**6,291,500**

1 ARB 2011 Greenhouse Gas Reporting Regulation.
2 ARB 2009 data used. Colmac facility is on an Indian reservation.

How much GHG emissions are avoided due to biomass conversion operations?

California biomass conversion operations result in net negative GHG emissions. While these facilities result in direct GHG emissions (mostly as carbon dioxide) when biomass is burned, the majority of these emissions are biogenic, and not counted as discussed above. In addition, these facilities produce electrical power that results in avoided utility emissions that would come mostly from the combustion of fossil fuels such as natural gas. Finally, biomass that is not combusted in a facility may otherwise be landfilled or "open" burned, resulting in more GHG and criteria pollutant emissions.

As shown in Table 4, preliminary estimates based on the facilities above indicate that biomass conversion facilities result in net negative GHG emissions of over 1 million MT CO2e, or -0.24 MT CO2e per ton of bone dry biomass. This is similar to a related ARB estimate (-0.21 MT CO2e/ton) for the recycling of dimensional lumber, assuming that it is chipped and burned in a biomass facility. (ARB, 2011). The staff estimated emissions include the direct CO2e non-biogenic emissions from Table 3, and credits for avoided utility emissions using the power capacity from Table 2 and an assumed overall output of 85% of capacity. Staff did not estimate transportation emissions associated with delivering waste to a facility, or emissions associated with processing waste, for example chipping wood. The estimates also did not account for avoided landfill emissions or avoided emissions from open-burning of biomass.

Table 4: Preliminary Estimates of Total Annual Net GHG Emissions from Biomass Conversion Facilities in California (year)

Biomass Waste (bone dry tons)	Non-biogenic Emissions (MT CO2e)	Total MWh	Utility Avoided Energy Credit MT CO2e[1]	Total Net Emissions (MT CO2e)	Net MT CO2e/Ton Waste
4,500,000[2]	120,000	4,051,000	-1,230,000	-1,110,000	-0.25

1 Uses 2009-2010 average California grid emission factor of 668 lb CO2e per MWh, and assumes facilities produce 85% of rated power capacity per Table 2.
2 Figure from 2012 Bioenergy Action Plan

Can GHGs and co-pollutants be reduced from existing or new biomass conversion facilities?

While acknowledging that most GHG emissions from biomass conversion facilities are biogenic, there is some potential to reduce GHG emissions from existing biomass conversion facilities, especially those that are not cogeneration facilities. When a "life-cycle" approach is used, net GHG emissions could be reduced by: (1) conversion to cogeneration, where heat (steam) is utilized on site, (2) upgrades to the boiler, turbine, or generator that could provide improvements in the efficiency resulting in more electricity generated per ton of biomass combusted; or (3) greater utilization of ash in beneficial uses such as construction materials where it could replace virgin materials

that would be mined or otherwise produced through processes that result in more GHG emissions.

Additional GHG reductions could come from restarting idled or non-operational biomass facilities, the conversion of fossil fuel plants to “co-fired” or 100% biomass fueled plants, or the construction of new biomass conversion facilities. Based on the emissions estimates in Table 4, the 22 operational plants in California result in an average annual emissions credit of 50,000 MT CO2e each. In addition, much of the biomass material available is not utilized. According to the 2012 Bioenergy Action Plan, less than 15% of the available biomass in California is utilized for energy. However, there are additional biomass conversion facilities that could be operational under more favorable economic conditions. Also, new designs in biomass conversion and gasification systems sized from 0.5 to 2 megawatts are now available that can provide heat and electricity for manufacturing or a small community. (UC, Woody Biomass Utilization). Finally, there may be benefits to the utilization of biochar, such as reducing nitrous oxide emissions and improving soil fertility for agricultural use.

What is the current status of emissions control at biomass conversion facilities?

These facilities are generally subject to local air quality district regulations and permit requirements. For new or modified facilities, “New Source Review” (NSR) regulations may require the use of “best available control technology” (BACT) for PM, NOx, SOx, or other emissions. NSR may also require the use of emission reduction credits (ERCs). In addition, federal rules that govern the permitting of new or modified facilities may apply.

The primary GHG emitted from biomass conversion plants is carbon dioxide, which is not controlled. However, as noted above, these facilities result in net negative GHG emissions. The plants have air pollution controls to reduce emissions of PM and NOx. For PM control, the facilities are equipped with various control devices, including multi-cyclones, baghouses, and electrostatic precipitators (ESPs). Permitted limits range from 0.01 to 0.2 gr/dscf at 12 percent carbon dioxide. For NOx control, the facilities most often employ selective non-catalytic reduction (SNCR).

IV. GOALS FOR REDUCING GHGS FROM BIOMASS CONVERSION FACILITIES

Biomass conversion facilities can play a role in achieving California’s goals for reducing GHG emissions and reducing the volume of material deposited in landfills. These facilities can help reduce GHG emissions from the Waste Sector in two ways: (1) new facilities can process additional waste that would otherwise be sent to landfills or open burned, and (2) as discussed above, existing facilities could be upgraded to improved energy efficiency. Discussed below are some existing state programs that will affect the extent to which GHG emissions can be reduced through biomass conversion facilities.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) program requires utilities to increase their procurement from eligible renewable energy resources from 20% of total procurement by December 31, 2013, 25% by December 31, 2016, and 33% by December 31, 2020. Under the program, utilities will pay a premium for energy from renewable sources. Under existing state law, biomass conversion facilities are eligible for renewable energy credit. This could potentially make existing and new biomass facilities more economical to operate. However, as noted in Section V below, the utilities are purchasing most of their renewable energy from other renewable sources.

Biomass Conversion Facilities and the Cap-and-Trade Program

California's Global Warming Solutions Act (AB 32) established the goals of reducing GHG emissions to 1990 levels by 2020, and then an 80% reduction below 1990 levels by 2050. A central element of AB 32 is the Cap-and-Trade Program, which specifies an enforceable GHG emissions cap that will decline over time covers. Cap-and -Trade applies to major sources of GHG emissions, sources that emit more than 25,000 MTCO2e per year. As shown in Table 3 above, biomass conversion facilities in California do not qualify as major sources since biogenic emissions are not counted toward the 25,000 MTCO2e major source threshold. Further, as explained above, these facilities result in net negative GHG emissions.

Governor's Clean Energy Jobs Plan

In 2010, Governor Brown set a goal of installing 20,000 MW of renewable electricity by 2020. To spur investment in renewable energy and help meet the state's ambitious climate goals, Governor Brown established a Clean Energy Jobs Plan. The Plan included a specific target of 12,000 MW of distributed generation which would include biomass conversion facilities.

V. CHALLENGES FACING BIOMASS CONVERSION FACILITIES

This section discusses the current and future challenges facing biomass conversion facilities. The challenges discussed below are divided into short-term and long-term issues.

C. <u>Short-Term</u>

Permitting of New Facilities

The vast majority of California's biomass conversion facilities were built in the 1980s, when regulatory and economic conditions were more favorable. Now these plants are 25-30 years old and will need to be upgraded or replaced. The overall permitting process, and sometimes local opposition, makes it very difficult to construct new plants. A recent report noted that a number of attempts have been made to restart non-

operational facilities since it is significantly less expensive than building a new facility. One reason for that is that old plants retain their original permits, while obtaining a permit for a new facility can be both expensive, uncertain, and time consuming. (California Agriculture, Volume 66, No. 1). The 2012 Bioenergy Action Plan also points out that some jurisdictions are ill-equipped to site and permit these projects, as they do not have the technical expertise or resources. Staff anticipates that the overall permit and construction process will take 3 to 5 years for biomass facilities.

New facilities are required to obtain several permits from different agencies. They are required to obtain permits from local jurisdictions, the Regional Water Quality Control Board, and local air quality management districts. Regarding the air quality permits, it would be difficult and expensive to site new plants using standard direct burn technology in California's non-attainment regions. New facilities would also face challenges preparing environmental documentation required by CEQA.

Financial Risk

The California Biomass Energy Alliance (CBEA) reported that a significant number of the existing biomass facilities have expiring contracts for their power and are facing uncertainty in the likelihood of contract renewal. Programs designed to spur bioenergy development at the CPUC, and recent procurement decisions of the Investor Owned Utilities (IOUs), have put existing biomass power facilities at a disadvantage for future renewable procurement opportunities (Draft 2013 Integrated Energy Policy Report, California Energy Commission, October 2013; http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-LCD.pdf). The Draft IEPR highlights the difficulty of bioenergy resources competing with other renewables with lower costs. Over generation is also a growing grid complexity that may negatively impact the need for biomass as a baseload operation, when IOUs are seeking more flexible power sources that can balance out daily swings in solar generation. The biomass industry argues that a mix of renewable energy procurement by the IOUs, which includes biomass, is critical to the long term sustainability in the Waste Management and Natural and Working Lands sectors. Under present conditions, the biomass industry will probably need changes in government policies, incentives, or other mechanisms to be viable beyond their current contracts.

Interconnection Costs

The cost and difficulty of interconnection to the transmission grid has been identified as a significant hurdle for new facilities.

Barriers to Increased Utilization of Forest Biomass

According to the 2012 Bioenergy Action Plan, there are a number of challenges to increasing the utilization of forest biomass for energy. Among the challenges is the cost of transporting waste to the facility, and concern that increased markets for forest wood

waste would promote more intensive harvest practices, resulting in unanticipated environmental impacts.

Gasification

Gasification of biomass has an advantage over conventional combustion in that it can potentially result in lower air emissions and higher thermal efficiencies. There are a number of commercial biomass gasification plants operationally internationally. However, the technology is only currently used at a few small facilities in California.

B. Long-Term

Development of Small Community-Scale Biomass Conversion Facilities

According to the 2012 Bioenergy Action Plan, smaller facilities would be a good fit for many rural communities. However, additional technical, financial, and stable supply of material is needed to encourage their development.

Emerging Technology

Conventional mass-burn plants produce combustion byproducts that require costly air pollution control equipment, and result in ash with limited market value. Emerging technologies may offer advantages in these areas, but more research is needed to demonstrate and commercialize these technologies.

Beneficial Uses for Ash Byproducts

In order to achieve a sustainable, zero waste system, beneficial uses need to be identified for the ash from biomass conversion plants. This includes both the boiler “bottom” ash and the “fly ash” from the air pollution control systems. A challenge with using ash is that it often contains toxic components which will impact acceptable uses of the material.

VI. POTENTIAL SOLUTIONS

Discussed below are some potential solutions to the challenges described above in our effort to achieve waste diversion and GHG reduction goals. As with the discussion of Challenges, the potential solutions are organized by short-term and long-term categories. Many of the potential solutions are discussed in the 2012 Bioenergy Action Plan. There may be additional solutions to the challenges beyond those mentioned below.

Short-Term

Permitting of New Facilities

The 2012 Bioenergy Action Plan (BAP) provided a number of suggestions to improve the permitting process for biomass facilities. First, it suggested that Cal-EPA funnel these projects through its Consolidated Permit Application process (Public Resources Code § 71020 *et seq*.) to coordinate the process. It also recommended that bioenergy developers consult with GO-Biz and Cal-EPA before they submit their project application to determine if the Consolidated Permit route would help their permit applications.

Another suggestion was the development of industry-specific web-based tools for planning and permitting guidance, links, and agency contacts. The 2012 Bioenergy Action Plan noted that Cal-EPA is planning to develop a web portal with permitting guidance for dairy digester projects, and an online "drop box" for other technologies to coordinate submission of environmental permits. It was suggested that this technology could be replicated for other types of bio-energy projects, including biomass electricity generation.

It was also suggested that funding be secured to develop a programmatic Environmental Impact Report (EIR). While this suggestion was targeted more to noncombustion conversion technologies (such as gasification and pyrolysis), it could also be applied to combustion of biomass as well. The EIR could assist state and local agencies in preparing site-specific environmental documentation that may be required for conversion technology facility applications and/or permits.

Finally, it was suggested that ARB and the local air districts provide manufacturers of bioenergy generation technologies with guidance on how to expeditiously permit bioenergy projects by proposing technologies that meet the latest regulatory requirements and how to retrofit existing facilities to meet tightening air quality regulations.

Financial Risk

The 2012 Bioenergy Action Plan provided several suggestions to improve the financial standing of new or existing biomass conversion facilities:

- Ensure that a substantial portion of the CPUC's Electricity Program Investment Charge (EPIC) fund is devoted to developing and commercializing new bioenergy facilities that are environmentally and economically sustainable, as well as upgrading and maintaining existing bioenergy facilities;
- Monitor the use of the CPUC's Renewable Market Adjusting Tariff ("Re-MAT") to assess whether and to what extent it incentivizes new bioenergy projects;
- Ensure that community-scale biomass projects benefit from the SB 32 feed-in-tariff and consider the use of other procurement mechanisms for small scale

bioenergy projects, such as Assembly Bill 1122, which requires the procurement of at least 250 MW of generating capacity from new bioenergy projects with an effective capacity of not more than three megawatts; and

- Identify GHG, criteria, and air toxic offset or credit opportunities that could assist in financing and siting bioenergy projects.
- Utilize Cap and Trade Auction Proceeds to provide competitive grants for bioenergy production.

Interconnection Costs

Regulatory changes could address the cost, timelines and other hurdles to interconnecting to the electricity grid. The CPUC has a rulemaking underway to address these challenges.

Barriers to Increased Utilization of Forest Biomass

The 2012 Bioenergy Action Plan provided these suggestions to increase the use of forest biomass:

- Outreach to landowners and registered professional foresters regarding the Board of Forestry and Fire Protection's regulations for Modified Timber Harvest Plan for Fuels Management;
- Outreach to the public regarding the benefits of biomass use, including reducing wildfire risk and production of local energy;
- Define and ensure sustainable forest biomass utilization for energy. These efforts are already underway by the Interagency Forest Work Group;
- Develop fire threat maps indicating areas of elevated fire risk due to power-lines(with accompanying plans removal of biomass); and
- Update the assessment of California biomass resources, identifying locations of biomass material and uses by region, assessing the value for fire hazard reduction, and recommended cost-effective strategies for use.

Gasification

Incentive or grant programs could aid in the increased utilization of biomass gasification in California. Many of these programs are discussed above under solutions to financial risk. As an example, the U.S. Forest Service approved a grant to complete the design and engineering services for installation and commissioning of a small biomass gasification unit on a former sawmill site in the rural community of North Fork, California.

Long-Term

Development of Small Community-Scale Biomass Facilities

The 2012 Bioenergy Action Plan provided a number of suggestions to encourage the development of these facilities, including refining the criteria of "community-scale"

biomass energy facilities, identifying a few candidate projects, and seeking developers and cost-sharing partners for deployment and demonstration.

Emerging Technology

State (and potentially Federal) agencies could coordinate resources to pursue research, development and commercialization of emerging state-of-the-art thermal technologies. As an example, the Energy Commission staff recommends that California state government should target installing 2,500 MW of renewable energy on state properties to help meet the overall 20,000 MW statewide goal in the Governor's Clean Energy Jobs Plan. Cal Fire is exploring opportunities for installing one to three biomass projects for heat and power using new technologies at Forestry Conservation Camps.

Beneficial Uses for Ash

State (and potentially Federal) agencies could fund research to supplement existing programs seeking to identify safe and beneficial uses for biomass conversion facility ash or other co-products such as biochar. Research is currently underway on potential uses of ash from MSW combustion. The results of this work may be applicable to biomass conversion waste also.

MUNICIPAL SOLID WASTE THERMAL TECHNOLOGIES
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I. INTRODUCTION

The primary focus of this paper is to identify challenges and potential solutions for achieving greenhouse gas (GHG) and waste reduction goals from municipal solid waste thermal technology (MSW Thermal) projects in California. The MSW Thermal processes discussed in this paper are thermochemical processes: MSW combustion, gasification systems and closely related technologies (e.g., pyrolysis and plasma arc), and the use of MSW as a supplemental fuel. Since conventional combustion operations are established in California, this paper provides more information for this technology compared to the other thermal technologies, which are not now in commercial operation in California. However, it is recognized that gasification, pyrolysis, and other non-combustion technologies provide additional options for handling MSW that may be used commercially in California at some point in the future. This paper does not provide a detailed technical discussion of the many emerging technologies that could potentially be used to treat MSW in California.

The sections that follow describe MSW Thermal processes, the current utilization of MSW Thermal in California, and the goals, challenges, and potential solutions for achieving additional reductions in GHG emissions and waste through the use of MSW Thermal facilities.

This paper is one of five papers providing information on the role various waste treatment technologies can play in meeting California's GHG and waste reduction goals. Companion papers discuss Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; Biomass Conversion; and Landfilling of Waste.

II. GENERAL DESCRIPTION OF THE MSW THERMAL PROCESS AND FACILITIES IN CALIFORNIA

What is MSW Thermal Technology?

MSW Thermal technologies are processes that generate energy in the form of electricity, fuel, or heat from thermochemical processes such as combustion or gasification of municipal solid waste. MSW Thermal facilities are also referred to as waste-to-energy or transformation facilities. Combustion processes involving biomass, and biological processes, such as composting and anaerobic digestion are discussed in other technical papers.

What are the MSW Thermal systems currently being used?

The MSW Thermal systems discussed in this paper are: conventional combustion systems, gasification systems, and the use of MSW (or components of MSW) as a

supplemental fuel along with conventional fossil fuels. Each of these systems is described below. Other thermochemical processes, such as torrefaction, are less prevalent and not discussed in this paper. Only combustion and supplemental fuel systems are in commercial use in California.

A. Conventional combustion ("transformation") systems

Conventional combustion systems combust mixed (unprocessed or minimally processed) solid waste in an incinerator. There are about 90 such systems in the U.S, 3 in California. While designs vary, a typical system involves the transfer of waste by crane from a pit to a moving grate incinerator where combustion takes place. Combustion gases flow through a heat recovery boiler, where water is heated to produce steam. The steam can be used to power a turbine and associated generator, producing electric power that can be provided to the electric power grid. MSW combustion systems will have multiple air pollution control devices to control emissions of sulfur oxides, nitrogen oxides, particulate matter, and other pollutants.

After combustion, the waste volume is typically reduced by 90% or more. Ash and metals are the primary residual materials. Ferrous metals are typically recovered from the residual material and recycled. Some newer facilities can recover nonferrous metals such as aluminum, copper, bronze, and brass. Ash can be landfilled with other wastes, used as a landfill cover material, or sent to a "monofill," where only ash is disposed of. The ash may contain heavy metals and other toxic components. However, research is underway to identify beneficial uses for the ash, such as use in road paving materials or construction materials. One operator is also investigating the possibility of recovering nonferrous metals from monofilled ash.

There are three MSW combustion facilities in California, as shown in Table 1 below. These facilities utilize combustion technology to combust unprocessed or minimally processed solid waste. Collectively, they have the capacity to process about 2,500 tons per day (TPD) of MSW, producing about 70 megawatts (MW) of electrical power. The three plants generally operate close to their rated capacity, although with scheduled downtime for maintenance, output may be 10-20% below capacity on average. All of the facilities have systems to collect ferrous metals, and one is currently planning to install a collection system for nonferrous metals as well. All of these facilities exceed the 25,000 metric tons CO2e threshold and are subject to the AB 32 mandatory reporting requirements. However, as discussed later in this paper, their status under the Cap-and-Trade Regulation is under review.

Table 1: MSW Thermal Combustion Facilities in California

Facility Name	Location	Start Date	Waste Capacity (TPD)	Electrical Capacity (MW)
Covanta Stanislaus	Crows Landing	1989	800	22
Commerce Refuse-to-Energy Facility	Commerce	1987	360	11.5
Long Beach SERRF	Long Beach	1988	1,380	36
Totals			2,540	70

A. Gasification systems

There are three main types of gasification systems: conventional, pyrolysis, and plasma arc gasification.

Conventional Gasification

Conventional gasification systems heat solid waste at high temperatures in an oxygen-deficient environment within a reactor vessel to produce synthesis fuel gases (syngas). The principal syngas products are carbon monoxide, hydrogen, methane, and other lighter hydrocarbons. Gasification processes may also produce liquids in the form of tars or oils, and solids such as char and ash. There are commercial gasification plants operating in Japan, Europe and North America that use MSW or sub-streams derived from MSW

Electricity and heat can be produced by burning the syngas in a steam boiler and turbine plant, a gas turbine, or an internal combustion or Stirling engine generator. The process may result in fewer pollutants than combustion, depending on whether the syngas is cleaned prior to combustion. Syngas can also be further processed to produce liquid fuels, fertilizers, and other chemicals by chemical reactions such as Fischer-Tropsch synthesis.

Pyrolysis

Pyrolysis systems thermally degrade solid waste in the absence of any air or oxygen. The process is similar to gasification but generally optimized for the production of fuel liquids or pyrolysis oils (sometimes called bio-oils if biomass feedstock is used). Pyrolysis also produces gases and a solid char product.

Pyrolysis liquids can be used directly (e.g. as boiler fuel and in some stationary engines) or refined for higher quality uses such as motor fuels, chemicals, adhesives, and other products. Direct pyrolysis liquids may be toxic or corrosive.

Plasma Arc Gasification

Plasma arc gasification systems use high voltage to create an electric field that heats MSW to extremely high temperatures. The intense heat breaks up the organic molecules into simpler gaseous molecules such as hydrogen, carbon monoxide, and carbon dioxide. The inorganic portion of the MSW is vitrified into a glassy residue that can be used in construction or paving materials. There are no plasma arc gasification systems in commercial operation in the U.S.

B. MSW as a Supplemental Fuel

MSW or specific types of waste that are segregated from the waste stream but would otherwise be deposited in municipal landfills can be used as a supplemental fuel in some facilities. For example, scrap rubber tires are used by some cement manufacturing plants in California. Specifically, according to data reported in response to the Air Resources Board's Energy Efficiency and Co-Benefits Assessment of Large Industrial Facilities Regulation (EEA Regulation), about 7 percent (1.8 million MMBtu) of the total energy consumed in 2009 by reporting cement plants was derived from scrap tires. According to the EEA data, dried sewage sludge was also used by some cement plants (less than 1 percent of total energy reported by cement plants). Some electricity generating plants have used scrap tires as a fuel in the past, but we are not aware of any of these facilities that currently combust scrap tires. In some cases, biomass is also used as a supplemental fuel, as discussed in the companion paper Biomass Conversion.

III. CURRENT STATUS OF MSW THERMAL FACILITIES IN CALIFORNIA

How much MSW is handled by MSW Thermal combustion facilities in California?

As shown in Table 2, the three MSW Thermal combustion facilities in California are processing about 2,500 tons of MSW per day, or about 900,000 tons per year. This is about 1 percent of the 73 million tons of waste material generated in 2010. It is not likely that there will be additional MSW Thermal facilities in the near-term without changes to existing State policies.

The three existing MSW Thermal facilities were all built in the late 1980s, and there are significant barriers to the construction of new facilities. These barriers include economics, restrictions on siting, air quality concerns, and the lack of renewable energy and waste diversion credits.

How much GHGs and co-pollutants are emitted from MSW Thermal facilities?

According to data reported for ARB's Greenhouse Gas Reporting Regulation, the three MSW Thermal facilities emitted about 747,000 metric tons of CO2 equivalent (CO2e) emissions in 2011, of which about 498,000 metric tons were biomass based (biogenic). The distinction between biogenic and non-biogenic GHG emissions is important because only the emissions from non-biogenic organic matter (fossil fuel based material such as plastics) are counted per protocols established by the Intergovernmental Panel on Climate Change (IPPC). A summary of the emissions from each of the three plants is shown in Table 2 below.

Table 2: GHG Emissions from California's MSW Thermal Facilities[1]

Facility Name	Total CO2e tonnes	Non-biogenic CO2e tonnes	Biogenic CO2e tonnes
Covanta Stanislaus	222,310	79,590	142,710
Commerce Refuse to Energy	108,920	53,760	55,160
Long Beach SERRF	415,650	115,790	299,860
Total	746,870	249,150	497,730

1 ARB 2011 Greenhouse Gas Reporting Regulation

How much GHG emissions are avoided due to MSW Thermal systems?

Although the California MSW combustion operations have not been fully assessed for their lifecycle GHG emissions benefits, there appears to be GHG emission reduction benefits to MSW Thermal compared to landfilling. The U.S. EPA's Municipal Solid Waste Decision Support Tool has demonstrated that modern conventional MSW Thermal combustion facilities avoid GHG emission in three ways:

- MSW Thermal facilities produce electricity that can offset electricity produced at conventional, petroleum-based, power plants using natural gas and coal.
- MSW Thermal facilities recover ferrous and/or nonferrous metals for recycling, which is more energy efficient than mining virgin materials for metals.
- MSW Thermal facilities remove materials from the landfill waste stream thus eliminating methane emissions that would have occurred if this material were landfilled.

U.S. EPA's Waste Reduction Model "WARM" provides estimates of the life-cycle GHG emissions from different waste management practices, including conventional combustion facilities. Table 3 shows the estimated direct and avoided GHG emissions for MSW Thermal using combustion technology. Direct emissions include non-biogenic CO2 and N2O from solid waste combustion and from transporting waste material.

Avoided emissions include reductions in utility emissions from displaced electricity and emission reductions associated with recycled metals. While not California-specific, it is illustrative of the direct and avoided emissions from MSW combustion facilities. As shown in Table 3, direct GHG emissions from mixed MSW combustion (0.40 MTCO2e per ton of waste) are less than the avoided emissions from both utilities and ferrous metal production from virgin ores. WARM also provides data for specific types of waste, some of which are included in Table 3. Yard trimmings and mixed paper result in very little emissions because CO2 emissions from biogenic waste are not counted under WARM, but burning this waste results in significant avoided utility emissions. In contrast, HDPE plastic results in significant direct facility emissions that are only partially offset by avoided utility emissions. Steel cans primarily result in avoided emissions due to recycling of the recovered metals.

Table 3: Estimated MSW Combustion Direct and Avoided GHG Emissions[1]
(MTCO2e/Ton Waste)

Material Combusted	Direct Emissions (CO2,N2O, transportation)	Avoided Emissions (Utility)	Avoided Emissions (Metal Recovery)	Net GHG Emissions
Mixed MSW	0.40	-0.39	-0.05	-0.04
Yard Trimmings	0.06	-0.22	0	-0.15
Mixed Paper	0.06	-0.55	0	-0.49
HDPE Plastic	2.82	-1.55	0	1.27
Steel Cans	0.03	0.02	-1.59	-1.59

1. Estimate based on U.S. EPA WARM (Version 12, February 2012). Direct Emissions of CO2 excludes biogenic CO2.

Since waste treated at a MSW Thermal facility would otherwise likely be landfilled, a comparison to landfill emissions based on the WARM model is provided below. As shown in Table 4, WARM estimates higher GHG emissions for landfills on average. However, the comparison varies with how the landfill gas is controlled. Net GHG emissions are very similar to MSW plants for landfills with gas recovery systems and electricity generation from the collected gas. However, WARM estimates that landfills which do not generate electricity from collected gas will have higher emissions per ton of waste, and landfills without gas recovery will have dramatically higher emissions.

Table 4: Estimated Direct and Avoided Landfill GHG Emissions[1]
(MTCO2e/Ton Waste)

Material Combusted	National Average	No Landfill Gas (LFG) Recovery	LFG Recovery with Flaring	LFG Recovery with Electricity Generation
Mixed MSW	0.98	3.10	0.31	-0.03

1. Estimated based on U.S. EPA WARM (Version 12, February 2012)

Official lifecycle emissions data for the three California MSW Thermal facilities is not available. However, preliminary staff estimates shown in Table 5 below indicate that combusting waste in the three MSW Thermal facilities in California results in net negative GHG emissions, ranging from -0.16 to -0.45 MT CO2e per ton of waste disposed, when considering that the waste would otherwise be deposited in landfills resulting in higher emissions. The estimates include the direct CO2 equivalent emissions (excludes biogenic CO2 emissions consistent with IPPC protocols and U.S. EPA WARM Model), and emissions credits for avoided utility emissions, recycling of metals, and avoided landfill methane emissions. Depending on the methodology used, avoided landfill emissions may range from 0.24 to 0.53 MT CO2e/MT of MSW. Emissions from the transportation of waste were not included (as they are in WARM), but this is a relatively minor factor in the overall emissions. Emission estimates related to landfill carbon storage associated with buried material was also not included. Staff believes that additional evaluation and discussion on how best to account for landfill carbon storage are needed.

Table 5: ARB Staff Preliminary Estimates of Net GHG Emissions from California MSW Thermal Facilities*

(MTCO2e/Short Ton Waste)

Facility	Waste (TPD)	Non-biogenic MT CO2E Emissions	Energy Credit MT CO2E[1]	Metal Recycled (Tons)	Metal Recycling Credit MT CO2E[2]	Avoided Landfill Methane Emissions MTCO2e[3]	Net MT CO2E per Ton Waste
Covanta Stanislaus	800	79,590	-49,740	5,690	-10,240	-70,080 to -154,760	-0.17 to -0.46
Commerce Refuse to Energy	360	53,760	-26,000	920	-1,660	-31,540 to -69,640	-0.04 to -0.33
Long Beach SERRF	1380	115,790	-81,390	6,500	-11,700	-120,890 to -266,960	-0.19 to -0.48
Total	2,540	249,150	-153,740	13,110	-23,600	-222,500 to -491,360	-0.16 to -0.45

1 Uses 2009-2010 average CA grid emission factor of 668 lb. CO2e per MWh, and assumes facilities produce 85% of rated power capacity per Table 1.
2 Uses a metal recycling credit of 1.8 MT CO2e per short ton of ferrous metal.
3 Estimated avoided landfill methane emission 0.24 to 0.53 MTCO2e/MT

Can GHGs and co-pollutants from existing MSW Thermal facilities be reduced?

GHGs and co-pollutants from MSW Thermal facilities can be reduced. However, the available options may only achieve modest emissions reductions. One option to reduce GHGs is to decrease the amount of non-biogenic organic waste (e.g. plastics) in the material being combusted. This is because only the GHG emissions from non-biogenic organics are counted per IPPC protocols. Other options to reduce GHGs and co-

pollutants, when a full "life-cycle" approach is used include: (1) improvements in front end pre-processing to recover recyclables (e.g., glass, plastics, cardboard) prior to combustion (2) upgrades to the incinerator, boiler, turbine, or generator that could provide some modest improvements in the efficiency of the plant, and associated electricity generated per ton of waste, (3) improvements in metals recovery equipment to increase the recovery of metals from the waste ash, or (4) increases in the use of ash in products such as construction materials where it could replace virgin materials that would be mined or otherwise produced through processes that result in more GHG emissions. Over the long term, newer MSW combustion technologies, such as gasification, may offer additional GHG benefits beyond existing mass-burn technology.

What is the current status of emissions control at MSW Thermal facilities?

The primary GHG emitted from MSW Thermal plants is carbon dioxide, which is not controlled. MSW Thermal plants have extensive air pollution controls to reduce emissions of criteria pollutants and toxic air contaminants. For example, the Covanta Stanislaus Facility utilizes flue gas scrubbers with lime injection to control acid gases such as sulfur oxides, fabric filter baghouses for particulate matter, selective non-catalytic reduction (ammonia injection) for nitrogen oxides, activated carbon injection for mercury, and a continuous emissions monitoring (CEM) system.

IV. GOALS FOR REDUCING GHG FROM MSW THERMAL FACILITIES

MSW Thermal facilities might play a role in achieving California's goals for reducing GHG emissions and reducing the volume of material deposited in landfills. MSW Thermal facilities can help reduce GHG emissions from the waste sector in two ways: (1) new MSW Thermal facilities could handle waste residuals that would otherwise be sent to landfills, where GHG emissions may be higher over the long-term; and (2) the emissions from the three existing facilities in California could be modestly reduced, as discussed above. GHG emissions reductions are maximized when recyclable and compostable materials are removed from the MSW prior to use at MSW Thermal facilities.

Existing State policies and the waste management hierarchy focus on the highest and best use of waste materials, i.e., recycling, composting and anaerobic digestion. With respect to newly proposed MSW thermal facilities, several statutory definitions, especially with regards to transformation and gasification, affect how such facilities might be permitted, whether or not they are considered disposal, and whether or not they are eligible for Renewable Portfolio Standard credits for the energy they would produce. There may be situations where residual MSW streams contain BTU value that could be recovered if converted to energy rather than being landfilled, but one major challenge would be to ensure these streams do not contain recyclable and/or compostable materials that could achieve greater emission reductions via recycling, composting, and anaerobic digestion. Initial steps to address this issue could be to develop a Material Recovery Facility standard that specifies the quality of a residual waste stream such that sufficient recyclables/compostables have been removed, and/or

to clarify a permitting pathway for facilities that use these types of residuals as a feedstock under specified conditions.

MSW Thermal Facilities and the Cap-and-Trade Program

California's Global Warming Solutions Act (AB 32) established a goal of reducing GHG emissions to 1990 levels by 2020, and then reducing GHG emission to 80% below 1990 levels by 2050. A central element of AB 32 is the Cap-and-Trade Program, which specifies an enforceable GHG emissions cap that will decline over time. The program applies to major sources of GHG emissions in the State, including the three MSW Thermal facilities in California. However, there are a number of concerns about including these facilities in the program, including the possibility that it may result in a shift of waste to landfills, which are not under Cap-and-Trade. Due to these concerns, ARB has proposed to temporarily exclude these three facilities from the Cap-and-Trade Program until 2015 to provide the time necessary to decide how best to treat MSW Thermal facilities in the context of the entire waste sector. Some potential options include: (1) remove MSW Thermal facilities from the Cap-and-Trade Program; (2) include the non-biogenic portion of emissions from MSW Thermal facilities in Cap-and-Trade; and (3) include MSW Thermal facilities in Cap-and-Trade and bring in other Waste Sector sources (such as landfills). These options are discussed in Section V below.

Renewable Portfolio Standard

The Renewable Portfolio Standard (RPS) program requires utilities to increase their procurement from eligible renewable energy resources to 33% of total procurement by 2020. Under the program, utilities will pay a premium for energy from renewable sources. This could make existing and new MSW Thermal facilities more economical to operate. However, under existing state law, only one of the three existing MSW plants (Covanta Stanislaus) is eligible for renewable energy credit, and new combustion facilities would not be eligible. New MSW Thermal facilities that meet the statutory definition of gasification (PRC 40117) would qualify as RPS eligible if the facility meets all the criteria in Public Resources Code Section 25741, Subdivision (b). Other MSW Thermal technologies, such as pyrolysis, that fall under the definition of transformation (PRC 40201) would not be RPS eligible.

V. CHALLENGES TO MEETING GOALS

This section discusses the current and future challenges facing MSW Thermal facilities in meeting California's waste diversion and GHG reduction goals. The challenges discussed below are divided into short-term and long term actions. In the short-term, many of the challenges will depend on the regulatory structure that applies to MSW Thermal facilities. Most of the challenges are interrelated. For example, government policies affecting MSW Thermal facilities will affect the financial challenges municipalities face in siting new MSW Thermal facilities. In turn, the economics of MSW

Thermal plants can affect the viability of other waste options, such as recycling, composting, and anaerobic digestion.

D. Short-Term Challenges

Permitting of New MSW Thermal facilities

MSW Thermal facilities operators are required to obtain several permits from different agencies in order to operate. They are required to obtain a full solid waste facility permit as described in the Public Resources Code Sections 44001 - 44018 and California Code of Regulations, Title 27, Chapter 4, Subchapter 3. In addition, they are also required to obtain permits from local jurisdictions, the Regional Water Quality Control Board, and local air quality management districts. The overall permitting process, including the local planning process and local land use decisions, along with large capital costs and local opposition to MSW Thermal facilities, makes it very difficult to construct new plants. The three existing MSW Thermal plants were all built in the late 1980s when government policies encouraged the construction of new MSW Thermal facilities. Staff anticipates that the overall permit and construction process will take 5 to 10 years.

Renewable Energy Credit

The ability to generate electricity that qualifies for renewable energy credit is an important factor in the development of new plants. Only one of the three existing MSW Thermal plants (Covanta Stanislaus) is eligible for renewable energy credit, and new combustion facilities would not be eligible without a legislative change. In addition, for gasification projects, several stakeholders have pointed out that the statutory definition is technically inaccurate and infeasible to meet, making it difficult for these projects to qualify for RPS credits.

Potential Conflict with Recycling Goals

As noted above, MSW Thermal facilities have the potential to reduce GHG emissions compared to landfilling of MSW. However, other waste options such as recycling, composting, anaerobic digestion, and biomass conversion result in even lower GHG emissions. However, there is not clear guidance on the extent of the efforts required to remove recyclable and compostable materials from the MSW stream prior to MSW combustion. One concern expressed is that the provision of incentives to MSW Thermal facilities could lead to increased use of feedstocks that could otherwise go to recycling, composting, and/or anaerobic digestion facilities.

Cap-and-Trade Program Impacts

Currently MSW Thermal facilities are regulated under the Cap-and-Trade Program. However, the ARB has proposed to temporarily exclude them from the program until 2015 to provide the time necessary to decide the best regulatory framework for these facilities and for the Waste Sector as a whole with respect to Cap-and-Trade. If MSW

Thermal facilities are under the Cap-and-Trade Program, GHG emissions from these facilities would be capped and need to decline over time. The main argument against this is that reducing the amount of MSW combusted or purchasing GHG credits are the only viable options for meeting the cap requirements. Some argue that reducing the amount of MSW combusted defeats the purpose of these facilities and will end up forgoing GHG emission reductions. Further, purchasing credits is likely to require increasing tipping fees to a point where it cannot compete with landfilling. This competitive disadvantage compared to landfilling will result in more waste being landfilled, resulting in more GHG emissions. MSW Thermal operators also report that they are already facing an uncertain economic future even without the potential impacts of the Cap-and-Trade Regulation.

Financial Risk

Municipalities face numerous financial risks in proposing new MSW Thermal facilities. MSW Thermal facilities are costly and face a lengthy process to obtain the necessary permits and address community concerns. There is a risk that new facilities will not perform as expected, especially with newer technologies. Finally, long-term financing may be necessary, but government policies and revenue generated from electricity can change over time in a way that affects the economic viability of a MSW plant. Even some of California's existing MSW Thermal facilities (Long Beach SERRF and Commerce Refuse to Energy) face an uncertain future in the next few years as electricity contracts expire. The current contracts provide price "floors" that provide much higher prices than current rates. When these contracts expire, rates paid for their electricity may fall by two-thirds, making these MSW Thermal plants potentially uncompetitive with landfills that are less expensive to operate and offer lower tipping fees.

B. Long-Term Challenges

Emerging MSW Thermal Technology

As noted above, conventional combustion MSW Thermal plants produce combustion byproducts that require extensive air pollution control equipment, and result in ash with limited or no market value. Gasification and related technologies may offer advantages in these areas, but the technologies are not yet mature. There are applications outside the U.S. handling relatively homogeneous waste. However, it is unclear whether the technology is feasible for unsegregated MSW.

Beneficial Uses for MSW Thermal Byproducts

In order to achieve a sustainable waste management system, beneficial uses need to be identified for the MSW Thermal combustion byproducts. Finding beneficial uses for incinerator "bottom" ash and "fly ash" from the air pollution control systems could reduce the carbon footprint of these facilities. However, care needs to be exercised in reusing

ash since it often contains hazardous or toxic components such as heavy metals and dioxin.

VI. Potential Solutions for Meeting Goals

Discussed below are some potential solutions to the challenges discussed. Many of the potential solutions are discussed in the 2012 Bioenergy Action Plan. There may be additional solutions to the challenges beyond those discussed below.

A. Short-Term Solutions

Permitting of New MSW Thermal Facilities

Building new MSW Thermal facilities could help California meets its GHG and waste reduction goals and increase ownership of the waste generated within California. If this path is taken, action could be needed to facilitate the permitting of new MSW Thermal facilities for the portion of the waste stream that cannot be managed via recycling, composting and anaerobic digestion, or biomass conversion. If needed, State and local agencies could work together to streamline the permit and siting process. The 2012 Bioenergy Action Plan also suggested the development of a programmatic Environmental Impact Report (EIR) for facilities using thermal technologies. The EIR could assist State and local agencies in preparing site-specific environmental documentation that may be required for conversion technology facility applications and/or permits. In order to address the concern that these types of facilities may use feedstock that could otherwise be recycled or composted, a performance standard would need to be developed, to allow regulators and operators to determine when sufficient recyclable and/or compostable materials have been removed.

Renewable Energy Credit

The ability for MSW Thermal facilities to generate qualified renewable energy will become increasingly important as utilities move toward the 33% renewable energy mandate in 2020. As stated above, only one of the three existing MSW Thermal facilities in California qualifies. In addition, there is some uncertainty about the status of other thermal conversion processes. Potential solutions include allowing all MSW Thermal facilities to generate renewable energy credits, subject to meeting requirements that protect air quality, recycling, and composting programs. The 2012 Bioenergy Action Plan also proposes a review of proposed legislation and statutory definitions relating to conversion technologies such as gasification to clarify which processes can qualify for renewable energy credit.

Potential Conflict with Recycling Goals

To protect recycling programs, front-end processing standards could be developed for waste sent to MSW Thermal plants to ensure that recyclable and compostable materials are removed prior to MSW conversion. These standards should incorporate safeguards

to protect existing recycling and composting systems and markets and allow for growth of these systems.

Cap-and-Trade Program Impacts

As discussed above, ARB staff is proposing to temporarily exclude the three MSW Thermal facilities from the Cap-and-Trade Program until 2015 to allow time for further investigation of the best approach for handling MSW Thermal facilities as part of an overall Waste Sector Plan. Discussed below are some potential options for addressing the issue of MSW Thermal facilities under Cap-and-Trade.

Remove MSW Thermal Facilities from Cap-and-Trade post-2015

Under this option, MSW Thermal facilities would be removed from the Cap-and-Trade Regulation for the foreseeable future. This approach would put MSW Thermal facilities on a level playing field within the Waste Sector, where none of the methods of handling MSW would be subject to the Cap-and-Trade Regulation. Under this approach, the incentive to reduce GHG emissions provided by the Cap-and-Trade Regulation would be removed. However, the GHG emissions from these facilities are already capped since they are operating at capacity. Further, given the age of these facilities and the uncertainty in long-term rates, the operating life of these facilities is likely to be limited. At the same time, the operation of MSW Thermal facilities (and other waste handling options) may need to be monitored over time to determine whether existing programs to increase recycling, minimize waste generation, and reduce emissions are sufficient to reduce GHG emissions over time. As necessary, additional programs or regulations may be needed that are tailored to MSW facilities or other waste handling processes. This approach may allow for a greater diversity of waste handling options that meet local needs (rural, urban, etc.) for both waste minimization and overall statewide GHG reductions goals.

Add MSW Thermal Facilities into Cap-and-Trade in 2015

Another approach is to add MSW Thermal facilities to the Cap-and-Trade program in 2015, while leaving other Waste Sector sources out. Under this approach, MSW Thermal plants would have an incentive to reduce their GHG emissions over time through control of input feedstock and other techniques. However, a challenge with implementing this approach is that MSW Thermal plants have a modest potential to reduce their GHG emissions. Over time, they may have to purchase more emissions credits, making them increasingly less competitive compared to traditional landfills. This approach would likely result in more GHG emissions if it results in an increase in MSW going to landfills.

Add MSW Thermal Facilities and Other Waste Sector Sources to Cap-and-Trade in 2015

Under this approach, MSW Thermal facilities and other options for handling waste (such as landfills) would be subject to the Cap-and-Trade Regulation. This would provide a level playing field for power generation and potentially avoid increases in waste disposal at landfills from a reduction in combustion of MSW. However, accurately quantifying the emissions from some waste sectors will be very difficult. For example, landfill emissions occur over a large surface area, and will vary based on the specific location on the landfill. Emissions are likely to vary based on environmental factors (temperature, climate, and moisture), system design and operation consideration, landfill activities, and other factors.

Financial Risk

All of the potential solutions discussed above could help reduce the financial risk that municipalities face in siting new MSW Thermal facilities. For example, streamlining the permitting process, developing a programmatic EIR, developing a performance standard regarding the processing of feedstock to remove recyclable and/or compostable materials, allowing MSW Thermal facilities to generate qualified renewable energy, and changing MSW facility's status under the Cap-and-Trade Regulation, could lead to projects that are more economically viable and thus less financially risky. In addition, the 2012 Bioenergy Action Plan discusses a number of potential options for providing low interest loans for renewable energy projects. To address the risk of implementing new MSW Thermal plants, state agencies could develop a guidance document on existing MSW Thermal facilities and their performance, both in and outside California.

B. Long-Term Solutions

Emerging MSW Thermals

State (and potentially Federal agencies) could coordinate resources to pursue research, development and commercialization of emerging state-of-the-art thermal technologies. Research could include a survey of existing technologies, the economic and technical performance of existing facilities worldwide, new technologies under development, and funding of pilot projects.

Beneficial Uses for MSW Thermal byproducts

State (and potentially Federal agencies) could fund research to supplement existing programs seeking to identify safe and beneficial uses for MSW ash. Existing research is underway looking at construction materials such as cement/ash blocks and roadway materials.

LANDFILLING OF WASTE
January 2014

I. INTRODUCTION

The primary focus of this paper is to identify opportunities, challenges, and potential solutions to achieve greenhouse gas (GHG) and co-pollutant reductions from landfills. The sections that follow, describe the waste disposal and GHG emission trends for landfills in California, applicable regulations affecting landfills, California's GHG and waste reduction targets, the challenges in meeting and exceeding these targets, and what actions need to be taken to meet these challenges. This paper is one of several papers being prepared to provide information critical to the discussion about the role that the Waste Sector can and should play in meeting the goals of Assembly Bill (AB) 32.

II. GENERAL DESCRIPTION OF LANDFILLS IN CALIFORNIA

How many landfills are there and how much waste do they hold?

There are about 370 landfills in California which due to their waste-in-place or permitted volume, waste age, and other pertinent factors have the potential to emit significant quantities of methane. Methane is a GHG with a global warming potential of about 21[52] times that of carbon dioxide. About 220 of the 370 are likely to be subject to ARB's Landfill Methane Control Measure (Landfill Measure), an AB 32 discrete early action measure adopted in 2009. The remaining landfills are likely to be exempted because they: ceased accepting municipal solid waste (MSW) prior to January 1, 1977, have waste-in-place that is below the 450,000 ton threshold, accepted only inert waste, or are hazardous waste sites. Approximately 1.2 billion tons of solid waste has accumulated in the State's landfills with an additional 30 million tons being added each year (ARB, 2009; CalRecycle, 2013).

What are the greenhouse gas emissions from landfills?

MSW landfills are the second largest anthropogenic source of methane in California (ARB, 2009b). The organic portion of solid waste disposed in MSW landfills decomposes to form landfill gas. Landfill gas contains approximately between 40 to 60 percent methane, 40 to 60 percent carbon dioxide, and trace amounts of non-methane organic compounds (NMOCs).

Depending upon the assumptions (collection efficiency, waste type, oxidation potential, etc.) and models used, fugitive emissions of methane from MSW landfills represent about one[1] percent of the statewide GHG inventory. If not captured, combusted, or treated in controlled systems, landfill gas can either be released into the atmosphere as

[52] The global warming potential for methane is in the process of being updated. Once updated, the fugitive emissions of methane from MSW landfills may represent one to two percent of the statewide GHG inventory.

fugitive emissions or migrate underground to cause groundwater contamination, cause explosive hazardous conditions in structures and utilities, or adversely impact nearby agricultural crops.

CURRENT STATUS OF LANDFILLS AND WASTE DISPOSAL TRENDS

How much and what type of materials are disposed of by landfilling?

About 37 million tons of MSW were disposed in California's landfills in 2010. The 37 million tons include disposal-related activities including: alternative daily cover, alternative intermediate cover, and beneficial reuse at California landfills; material combusted at the three MSW mass burn facilities; and tire derived fuel. The estimated composition of waste currently disposed is presented in Table 1.

Table 1. Composition of Currently Landfilled Solid Waste in California[1]

Material[2]	MM Tons[3]	Percentage of Solid Waste
Paper	5.4	15%
Glass	0.5	1.4%
Metal	1.5	4.0%
Plastics	3.0	8.2%
Food	4.8	13%
Green	4.0	10.9%
Lumber	4.4	12%
Other Organics	3.5	9.5%
Other Inerts	6.3	17%
Household Hazardous Waste	0.09	0.3%
Special Waste	2.2	6.0%
Electronics	0.17	0.5%
Mixed Residue	0.93	2.5%
Total	**37[4]**	**100%**

1. Source: CalRecycle (2010).
2. Definitions of material types are available at: http://www.calrecycle.ca.gov/wastechar/MatDefs.htm
3. Includes disposal related activities (ADC, AIC, and beneficial use), material combusted at MSW mass burn facilities; and tire derived fuel.
4. Numbers may not total exactly due to rounding.

What are the landfill disposal rates and trends?

- California residents generated a twenty-year average of 10.7 lbs/person/day of disposed materials from 1990 through 2010 (CalRecycle, 2012).

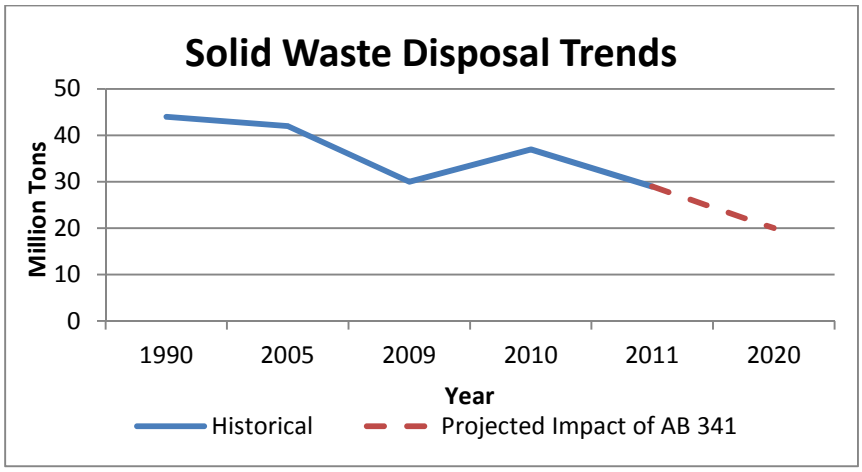
- Approximately 30.4 million tons of MSW were disposed in California's landfills in 2010, and another 5.8 million tons of waste materials were used in disposal-related activities at landfills including alternative daily and intermediate covers, and other beneficial reuse (as defined by Title 27 California Code of Regulations, section 20686), and as fuel (waste tires and solid waste residuals).

- About 0.9 million tons were burned (transformed) at three permitted MSW mass burn facilities in California. Provisions in the Public Resources Code, sections 40201 and 41783 allow limited diversion credit for transformation.

- Almost all (99 percent) of the California-created solid waste that is not recycled or diverted from waste disposal is landfilled in California. It is estimated that there is a potential of about 1.5 to 3 billion tons of landfill capacity available statewide should all permitted capacity be built and utilized. According to the American Society of Civil Engineers, California has sufficient landfill capacity through 2037. However, there may be some localized or regional landfill capacity issues. Should the 75 percent recycling goal be reached, the localized capacity issues will diminish and the overall state capacity will be extended.

- There has been an overall decline in waste disposal by landfilling over time. The decrease in tonnage is primarily related to both increased recycling efforts (e.g., AB 939 discussed is Section IV.) and the economic downturn. This trend is shown below in Figure 1. It includes material disposed in landfills, used in disposal related activities, material combusted at MSW mass burn facilities and tire derived fuel. With medium growth projections, landfill disposal is estimated to increase to 43 million tons in 2020. If the 75 percent recycling goal is met, disposal would decrease to approximately 21 million tons of material disposed in landfills in 2020.

Figure 1. Waste Disposal Trends in California



1. Data from 2010 forward includes both disposal and disposal-related trends.

How much greenhouse gas emissions do landfills emit?

ARB staff estimates that landfills in California emitted approximately 6.72 MMTCO2e in 2010. Based on 2006 data, GHG emissions from MSW landfills were estimated to be about 6.3 MMTCO2e in 1990. In 2000, the GHG emission level dropped to 5.8 MMTCO2e. However, landfill methane emissions are extremely difficult to estimate and are subject to substantial uncertainty. Recent limited direct measurement studies and computer modeling (CALMIM) indicate that landfill methane emissions may be higher than previously estimated (CalRecycle, July 2012). However, additional work is needed to evaluate the results of these limited studies and determine if it is appropriate to modify existing or develop new models to more accurately estimate landfill methane emissions.

During the time period 1990 to 2008, the solid waste and recycling industry reduced GHG emissions from landfills through increased recycling, improved biomass utilization, and more efficient landfill gas control. State, local air district and U.S. EPA also instituted several landfill gas control measures [e.g., ARB's suggested control measure for landfill gas emissions (1990), local air district landfill gas rules, and federal new source and hazardous air pollutant standards] to reduce landfill gas emissions. Although these measures targeted primarily NMOCs and volatile organic compounds (VOCs), they had the added benefit of reducing GHG emissions such as methane. In 2009, ARB adopted the Landfill Measure to reduce methane emissions from landfills by an estimated 1.5 MMTCO2e by 2020.

How can GHG and co-pollutant emission be reduced at landfills?

The GHGs and co-pollutant emissions from landfills are reduced in two ways; either by capturing landfill gas or by reducing organics going into landfills. Landfill gas can be controlled by installing and operating an active gas collection and control system. The captured gas is then routed to a control device where it is combusted with or without energy recovery. The gas can also be sent to a pretreatment unit where it is processed and used as a product or shipped offsite for further processing or use. Optimizing gas collection efficiency is dependent on landfill design, operation and maintenance of the gas collection system, and closure/post-closure practices. Reducing the amount of organic materials going to landfills will help reduce future methane emissions. This is particularly true of materials that tend to decompose rapidly such as green waste and food waste.

What is the current status of emissions control at landfills?

Due to federal and local landfill gas rules, most of the approximate 220 landfills subject to the Landfill Measure have landfill gas collection and control systems. About 20 of the 220 have submitted plans to upgrade their existing gas collection and control systems to meet the requirements of ARB's Landfill Measure. Also, because of age and/or older technology, additional existing gas collection and control systems could be upgraded to maximize system efficiencies. We anticipate that about 14 landfills without gas

collection systems will be required to install gas collection and control systems or demonstrate that their emissions are too low to support such a system.

III. GOALS FOR REDUCING GHG EMISSIONS FROM LANDFILLS

A. Legislation and Regulations

Two key pieces of legislation – AB 32 and AB 341 – provide the framework for reducing GHG emissions from the Waste Sector and meeting California's waste reduction goals. AB 32 established a goal of reducing GHG emissions to 1990 levels by 2020 and then further reducing GHG emissions 80 percent below the 1990 levels by 2050. The 2008 AB 32 Scoping Plan initiated the process of identifying opportunities to achieve GHG emission reductions from the Waste Sector. Control of landfill methane emissions was identified as an early action measure. The 2008 Scoping Plan also identified the need for mandatory commercial recycling and other programs for developing and implementing alternatives to landfilling.

The ARB Landfill Measure (adopted in 2009 and effective June 17, 2010) imposes landfill gas collection and control system requirements (new systems for landfills without systems meeting thresholds and higher standards for existing systems) to reduce methane emissions from landfills. The implementation and enforcement of the Landfill Measure is expected to result in a GHG emission reduction of 1.5 MMTCO2e, which exceeds the established goal of 1.0 MMTCO2E presented in the 2008 AB 32 Scoping Plan and would represent a 20 percent reduction in landfill methane emissions compared to the 1990 levels. Larger MSW landfills are also subject to the federal New Source Performance Standards and Emission Guidelines (implemented by local air districts) to reduce NMOC, VOC and methane emissions.

AB 341 established a goal of 75 percent reduction in waste through recycling, composting, and other waste reduction efforts by 2020. To achieve this goal, about 22 million tons per year of solid waste would need to be shifted to non-landfilling alternatives by 2020. Preliminary analysis using one model (ARB's Landfill Emissions Tool) indicates that an additional 0.61 to 0.74 MMTCO2e reduction in 2020 and 3.8 to 5.5 MMTCO2e in 2050 is possible if the AB 341 policy goal is met.[53] Using other models and/or assumptions will generate different results. However, in all cases diverting organic waste from landfilling will reduce methane generation and subsequent emissions from landfills.

Shifting material from landfills and using this material as feedstock in recycling and remanufacturing will also achieve significant upstream GHG emission reductions. Re-introducing recyclables with intrinsic energy value back into the manufacturing process reduces GHG emissions from multiple phases of product production including extraction

[53] The estimated emissions reductions are based on results from the ARB Landfill Emissions Tool using CalRecycle estimated disposal tonnages through 2050. Scenarios evaluated a baseline with no increased recycling, a scenario meeting the 75 percent recycling goal by 2020, and a scenario meeting the 2020 75 percent recycling goal with significant reductions in the organic fraction of the landfilled waste stream.

of raw materials, preprocessing, and manufacturing. To the extent that recycling/remanufacturing occur in California, it would further support AB 32 goals of creating jobs in California and reducing our reliance on export markets to handle waste.

A key component in implementing the 75 percent goal in AB 341 is CalRecycle's Mandatory Commercial Recycling regulation which became effective May 7, 2012. The Mandatory Commercial Recycling regulation builds on the existing AB 939 residential recycling framework. The goal of AB 939 was to require each city or county to divert 50 percent of all solid waste by January 1, 2000, through source reduction, recycling, and composting activities. The Mandatory Commercial Recycling regulation establishes a statewide mandatory commercial recycling program which requires that business and multifamily residential dwellings (of five units or more) that generate four cubic yards or more of commercial solid waste per week to arrange for recycling services.

Two recently enacted bills, AB 1900 and AB 2196, may impact the use of landfill gas. AB 1900 (Gatto, Statutes of 2012) requires the California Public Utilities Commission (CPUC) to develop standards for constituents in biogas to protect human health and pipeline integrity and safety. In support of the CPUC standards development efforts, the Office of Environmental Health Hazard Assessment (OEHHA) and ARB, in consultation with other State agencies, are to undertake certain actions. Specifically, OEHHA is tasked with compiling a list of constituents of concern found in biogas that could pose a health risk and that are at levels that significantly exceed the concentrations of those constituents in natural gas. OEHHA is also to determine health protective levels for these constituents, after considering potential health impacts and risks. ARB is tasked with developing realistic exposure scenarios and identifying the associated health risk to utility workers and end users; determining the concentrations of these constituents in biogas necessary to protect public health; and identifying monitoring, testing, reporting, and recordkeeping requirements necessary to ensure that health protective levels are maintained. ARB and OEHHA submitted their recommendation to the CPUC on May 15, 2013. The CPUC is to adopt a final regulation by December 31, 2013.

The Statutes of 2012 impose certain requirements for eligibility of biomethane under the Renewable Portfolio Standards (RPS) program. It establishes minimum electricity targets for electrical corporations in their annual procurement updates to procure electricity from landfill gas. Moreover, the legislation requires the adoption of policies to promote in-state development of biomethane from wastewater treatment facilities and dairy farms.

The United States Environmental Protection Agency (U.S. EPA) is conducting a review of the New Source Performance Standards (NSPS) and Emissions Guidelines (EG) for MSW landfills and may consider setting more stringent limits on landfill gas emissions among other actions. U.S. EPA is planning to have a draft revised rule in February 2014 and a final rule by December 2014. It is anticipated that the proposed NSPS emission standards will not be as stringent as California's current landfill methane controls. However, the impact of the proposed emission standards, if any, will be assessed once EPA finalizes the proposed rule.

B. Permitting and Regulation of Landfills

Before a landfill begins operation, landfill operators/owners are required to obtain permits and satisfy regulations pertaining to landfills. For example, landfills are required to obtain local Land Use Approvals from local planning (land use) agencies; State Solid Waste Facility Permits which are typically issued by Local Enforcement Agencies operating under CalRecycle regulatory oversight; waste discharge requirements (WDRs) from the appropriate Regional Water Quality Control Board; and air quality permits from local air districts. Furthermore, landfill operators need to meet hazardous waste requirements from the Department of Toxic Substances Control for Class I landfills, which are exempted from ARB's early action Landfill Measure.

IV. CHALLENGES TO MEETING GOALS

E. Short-Term

The challenges to further reduce GHG emissions from landfills and solid waste going into landfills are both short-term and long-term. The following provides a brief discussion of the short-term challenges.

Uncertainly in Landfill Emissions

Landfills are complex sources of methane (GHG) emissions. Depending upon site specific conditions, methane may be released for decades (and potentially centuries) after material is placed into the landfill. Current law also allows (pending several conditions being met) for decommissioning of gas systems before all the waste has been completely degraded.[54] Given the scale and scope of landfills and the variability in landfill sites, accurately predicting methane emissions from landfills with a high degree of certainty is difficult. Additional research is needed to improve both direct measurement and model estimation techniques of landfill methane emissions.

Regulatory Actions and Interagency Collaboration

Implementation of "Best Management Practices" (BMPs) for landfills may provide even greater reductions of GHG emissions from landfills. Such actions may include: specific requirements for gas collection system design, construction, timing, and operation; landfill unit and cell design and construction; waste placement methods; daily and intermediate cover materials and practices; use of compost or other biologically active materials in cover soils; phased closure or early landfill closure; and management of organic materials via composting or anaerobic digestion.

[54] ARB's landfill methane control measure only permits gas collection and control equipment removal after 15 years provided surface emissions standards are consistently being met. In some cases, landfills may be required to submit additional data supporting a request for equipment removal. In addition CalRecycle regulations require the landfill operator to demonstrate that subsurface migration of landfill gas above regulatory standards will not occur before the gas control equipment may be removed.

The feasibility of a more stringent surface methane emissions limit should be evaluated. The Landfill Measure establishes an instantaneous surface methane emission limit of 500 parts per million by volume (ppmv). ARB staff had initially proposed a more stringent instantaneous surface methane standard of 200 ppmv; however, stakeholders expressed the concern that this may cause potential subsurface fires to occur due to overdraw on their gas collection systems. ARB staff will be evaluating data collected via required regulatory reporting on all instantaneous readings of 200 ppmv and greater to determine if a more stringent limit can be met.

Promote the Beneficial Use of Landfill Gas

Most of the landfill gas captured in the State is done so without energy recovery or the gas being used as a product. Local air district rules and emission offsets requirements along with expensive pretreatment costs to remove impurities from landfill gas may be factors in limiting or making some landfill gas-to-energy (LFGTE) projects unfeasible. Furthermore, most landfills are typically located in remote areas and not close to pipelines making it difficult to inject the gas (after proper processing) directly into a common carrier pipeline. These issues need to be addressed in order to further promote the beneficial use of landfill gas.

Landfill gas from existing waste in place may provide a viable source of liquefied natural gas (LNG) or compressed natural gas (CNG) vehicle fuel with carbon benefits under ARB's Low Carbon Fuel Standard. Landfill gas from existing waste in place is also being evaluated along with anaerobic digester gas for potential treatment and use in California as renewable high Btu to inject in natural gas pipelines.

A consequence of diverting organics from landfills would be a decline in future methane generation (beyond that already anticipated from existing waste in place). While this may negatively impact the economic viability (and capital investments by public and private parties) of both existing and potential landfill gas to energy projects, reducing the amount of organic waste being landfilled would also result in significant GHG emission reductions. Furthermore, these same organic materials could instead be used in composting and anaerobic digestion activities.

Greater Diversion of Readily Recyclable Materials

Achieving additional reductions in GHG emissions from landfills will require greater removal of recyclables, compostable, and digestible materials. To assist in prioritizing actions additional emission reduction factors need to be developed and some of the existing factor need to be updated.

F. Long-Term

Identified long-term challenges in effectively meeting, implementing, and exceeding the requirements and goals that are in place, and therefore reduce GHG emissions and solid waste going into landfills, are summarized here:

Further Evaluate Landfill Gas Collection Efficiencies for California Landfills

Data on landfill gas collection efficiency is limited and further research is needed. However, measuring uncontrolled landfill gas emissions is problematic because the emissions vary over space and time making it very difficult to accurately quantify emissions. Landfill gas generation rates are highly variable due to several site specific factors including: rainfall, landfill temperature, waste composition, age of the waste, and other factors. The impact on gas collection efficiencies from implementation of the Landfill Measure should also be evaluated.

Improved Emissions Inventory Data

More complete California-specific data on landfill gas collection and composition will help improve emission estimates from the model used by ARB staff. Better information on the cover types present at landfills and further details on gas collection systems will allow for better collection and oxidation factor estimates.

Landfill methane emissions are extremely difficult to characterize and subject to substantial uncertainty. Recent limited direct measurement studies and modeling methods (CALMIM) indicate that landfill methane emissions may be higher than previously thought (CalRecycle July 2012 Report on Landfill Avoided Emissions and WtE). Additional resources/research would be needed to improve landfill methane estimations techniques (both direct measurement and modeling).

Markets

More markets and more stable markets for recycled, reprocessed, or remanufactured goods are needed within California to achieve our GHG emissions and waste reduction goals. To obtain future reductions of GHG emissions from landfills, recyclables must be shifted from landfills. This will require markets for compost and recycled materials. While the State can utilize its purchasing power to increase demand for compost and recycled materials, additional incentives are needed. Compared to landfilling, these environmentally beneficial alternatives are more expensive. The prevalence of less expensive landfilling makes composting and anaerobic digestion economically marginal industries, even though they create jobs and beneficial products, and reduce emissions. To further reduce landfill emissions from landfills that utilize flares for methane destruction from existing in-place waste, markets for produced electricity and landfill gas energy products would need to be developed to assist in shifting to energy producing projects that would possibly replace fossil fuels. Markets will be needed to purchase the electricity produced by LFGTE projects and/or other uses, such as landfill gas being

used as a product (e.g., LNG, CNG, pipeline quality gas), or for shipment offsite for use in energy production.

V. Potential Solutions for Meeting Goals

Some potential solutions for overcoming the challenges to further reduce GHG emissions and solid waste going into landfills are summarized here:

A. Short-Term

Uncertainly in Landfill Emissions

The Landfill Measure requires the collection of data on an annual basis that will be used to improve estimation of GHG emissions from existing waste in landfills. This information will be provided to emissions inventory staff to further update the landfill inventory.

Although reducing organics disposal into landfills will produce the greatest GHG emissions reductions, to quantify these GHG emissions reductions, new and updated emission reduction factors will need to be developed, especially with respect to avoided methane emission for organics shifted to non-landfill alternatives. For example, an emission reduction factor for carpet is needed.

Regulatory Actions and Interagency Collaboration ("Phase II")

ARB staff will review its early action Landfill Measure and CalRecycle regulations and work with CalRecycle staff to investigate what regulatory actions can be taken to further reduce GHG emissions at landfills. These actions may include incorporating the BMPs identified under the short-term goals section of this report into the Landfill Measure. Additionally, ARB staff has collected approximately two years of surface methane emissions monitoring data from MSW landfills pursuant to the Landfill Measure. ARB staff will analyze the data to determine if the analysis indicates whether a 200 ppm instantaneous surface methane standard is feasible and does not result in potential adverse impact(s) on landfills and their control systems.

CalRecycle staff continues collaboration with ARB, OEHHA, California Energy Commission, and the CPUC in implementing AB 1900 and AB 2196 to maximize the safe and economically viable recovery of solid waste-related bioenergy resources.

ARB staff will work with U.S. EPA to avoid, or minimize the potential for duplication and/or inconsistencies between the Landfill Measure and USEPA's draft revised rule for MSW landfills.

Promote the Beneficial Use of Landfill Gas

Special incentives, such as tax breaks or grants, may encourage landfill owners/operators to switch from installing inexpensive flares to more costly LFGTE systems. Landfills located close to pipelines should be identified and the feasibility of using their gas for injection into pipelines evaluated.

To incentivize and negate profitability issues, it would be helpful to have incentive payments and/or grant programs for projects that would reduce waste to landfills and also reduce GHG and co-pollutants emissions.

However, incentives for LFGTE systems may have an unintended consequence of promoting landfilling of organic waste in lieu of moving organics to composting, anaerobic digestion, and other non-landfilling alternatives and impacting the 75 percent recycling goal.

Greater Diversion of Readily Recyclable Materials

It would be helpful to increase markets for compost and remanufactured products and accelerate the deployment of anaerobic digestion projects. This may be accomplished via incentives or requirements for the targeted increased procurement by state agencies.

Consider ARB regulations requiring phasing organics out of landfills and moving toward inert only landfilling practices.

Consider whether landfills should be included in the Cap-and-Trade.

B. Long-Term

Further Research

- Research to improve our understanding on landfill gas collection efficiencies should be solicited in order to evaluate “typical” collection efficiencies at landfills within California. The impact on collection efficiencies for these landfills resulting from implementation of the Landfill Measure should be further evaluated.

- Research on the technologies needed, as well as education, to provide the needed education and outreach of contamination free feedstock for the processes.

- Develop contract concept(s) and funding source for statewide characterization of landfill methane emissions by best available direct measurement methods and validation of Inventory models.

- Research and demonstration projects for methane capture equipment(s) and technology to convert it to commercial LNG are needed.

Appendix B: Waste Management Sector Listing of Follow-Up Actions
January 2014

The table below provides ARB and CalRecycle staff's current listing of follow-up actions identified in the six technical papers: Recycling, Reuse, and Remanufacturing; Composting and Anaerobic Digestion; Biomass Conversion; Municipal Solid Waste Thermal Technologies; Landfilling of Waste; and State Procurement. The table is meant to serve as a guide to aid agencies, industries and the public in the ongoing process of information gathering and analysis. The table below presents an initial set of potential actions and the estimated timeframe for completing these actions. Any actions taken by state and local agencies that result in the development of regulations or an action that must receive discretionary approval will undergo a full environmental review as mandated by CEQA.

High priority activities to receive focused attention are shown in green highlights. High priority actions already underway are highlighted in pink. Other actions will be pursued as incoming data merit and as resources permit.

Category/Task	Actions	Timeframe
1. Emission Reduction Factors	a. Revise compost emission reduction factors to include avoided landfill emissions as well as compost emissions	Short term/in progress by early 2014
	b. Develop new emission reduction factors for aerobic and anaerobic digestion that include avoided landfill emissions as well as digestion process emissions	Short term/2014
	c. Develop emission reduction factors for additional materials that can be recycled (carpet, paint, rubberized asphalt concrete, others)	Short term/2014
	d. Update emission reduction factors for landfills, including avoided methane emissions for organics that are shifted to non-landfill alternatives	Short term/mid-2014
	e. Consider any additional quantifiable data on end use of exported recyclables and incorporate into updates of existing emission reduction factors as needed and development of new emission reduction factors	Short term/2014-2020, ongoing element
2. Permitting	a. Work with State agencies, air districts, jurisdictions, and U.S. EPA to address conflicting or redundant requirements, including cross media and multi-jurisdictional issues	Short term/mid-2014, ongoing element
	b. Identify challenges and recommend adjustments to improve permitting process for new and upgraded facilities – develop programmatic EIRs and/or model permit and guidance documents to assist in environmental review and CEQA	Short term/2013-2014 (compost), 2013-2015 (AD)

	c. Work with Institute for Local Government and others to develop industry specific web-based tools for planning and permitting guidance	Short term/mid-2015, ongoing element
	d. Investigate opportunities for co-location of organics processing at POTWs and landfills	Short term/mid-2015, ongoing element
	e. Work with the Regional Water Quality Control Boards regarding use of digestate on farmlands	Long term/ongoing through 2025
	f. Assist Water Board in air quality impact analysis for the Composting General Order EIR	Short Term/2014
3. Funding & Incentives for Infrastructure (also see Category 8)	a. Investigate various funding sources, including the potential use of Cap & Trade auction funds, for incentives, grant and loan programs for new projects and existing facility improvements to meet air, water, and EJ goals and to develop sustainable low-carbon waste management systems to handle waste shifted from landfills to compost, anaerobic digestion, biomass, recycling, remanufacturing and other technologies	Short term/2013-2014, ongoing element
	b. Identify opportunities to make instate baseload renewable electricity production more competitive through feed-in tariffs, direct access agreements, and other financial mechanisms	Short term/2013-2020
	c. Continued implementation support of AB 118 funding for anaerobic digestion projects	Short term/2014-2015, ongoing element
	d. Continue to provide regulatory certainty that fuel produced from anaerobic digestion of organic waste can qualify for Low Carbon Fuel Credits. Continue developing Low Carbon Fuel Standard (LCFS) pathways of waste-derived fuels including “wet” AD and wastewater facility biomethane production for Low Carbon Fuel Credits for anaerobic digestion	Short term/2013-2015, ongoing element

	e. Pursue expanded sustainable financing for infrastructure development for recycling, composting, anaerobic digestion, and biomass projects: a. Expand RMDZ program (including recapitalization & fund stabilization) b. Obtain GoBiz support and expand technical support c. Identify, prioritize, and establish a timeline for developing offset protocols for recycling, composting, anaerobic digestion or other bioenergy processes d. Establish remanufacturing incentive payments, grant programs, or product stewardship programs to manage high–GHG commodities e. Support tax credit legislation to benefit remanufacturers in California	Short term/2014-2015, ongoing element
	f. Establish incentive programs geared to biomass conversion projects, including gasification projects, possibly through Cap-and-Trade revenues	Short term/2014-2020
	g. Encourage that the EPIC fund is devoted to new bioenergy facilities. Explore tax credits	Short-midterm/2014-2020
	h. Investigate the costs, application process, and potential improvements associated with interconnection to the transmission grid from biomass conversion projects	Short-midterm/2014-2020
	i. Identify landfills close to pipelines and evaluate economic feasibility of biogas injection for existing waste-in-place. Continue work with CPUC on pipeline injection issues. See 9c	Short term/2014-2015
	j. Monitor the Renewable Market Adjusting Tariff to assess whether it incentivizes new bioenergy projects	Short-midterm/2015-2020
	k. Investigate the feasibility of criteria pollutant offset banks for new composting & AD facilities and the generation of offsets by upgrading existing facilities to reduce emissions	Short-midterm/2015-2020
	l. Evaluate pros and cons of incentivizing municipal solid waste thermal technologies (MSW Thermal) by allowing renewable energy credits	Short term/2014-2015

4. Public Education /Acceptance	a. Initiate focused public education and outreach addressing: goals of waste sector, benefits of recycling/remanufacture in California, collection of cleaner recyclable commodities, need for contamination-free feedstocks, reducing carbon footprint through increased recycling, and purchasing California recycled products	Short term/2013, ongoing element
	b. Educate project developers about next generation organic processing facilities that minimize odors and emissions and can be sited closer to urban centers	Short term/2013-2020, ongoing element
	c. Foster State, local, and private cooperation in achieving Waste Sector Goals	Long term/ongoing through Mid-term
	d. Evaluate effectiveness of education programs and modify as needed	Long term/2015, ongoing element
	e. Provide education on State procurement requirements to all State agency purchasing officials and all staff within agencies, as well as state contractors, who purchase materials	Short term/2013-2020, ongoing element
5. Markets/Quality of Products	a. Evaluate feasibility of maximizing recovery potential by establishing performance standards for MRFs and C&D facilities to recover higher-quality commodities	Short term/2013-2020
	b. Support development of advanced processes and/or equipment that enables cost effective removal of contaminants from the organics waste stream, particularly glass and plastic	Short term/2013-2020
	c. Increase markets for anaerobic digestion and compost products by investigating potential financial incentives for increased usage of compost and anaerobic digestion products. See 8a.	Short term/late 2013/early 2014
	d. Work with industry to standardize quality specifications for products from composting and anaerobic digestion	Long term/ongoing through 2025
	e. Identify and support markets for recycled, reused, and remanufactured materials	Short term/ongoing through 2035
	f. Work with stakeholders to promote the sorting of urban organics	Short-midterm/2013-2020
	g. Create system to verify PCRC of products, identify suppliers of PCRC products, and track State procurement; require manufacturers and suppliers to disclose product environmental information	Short-midterm/2013-2020
6. Sustainability	a. To maximize the effectiveness of recycling, composting, and AD programs, investigate establishing front-end processing standards for waste sent to MSW-thermal plants	Short term/2013-2015

	b. Promote source reduction principles into packaging and product design; foster recycling and recyclability as a front end design parameter for packaging and products that cannot be reduced; maximize recycling markets	Long term/ongoing element
	c. Evaluate opportunities to source reduce and promote reuse of materials	Long term/ongoing element
	d. Develop new product stewardship programs(e.g., mattresses)	Long term/ 2013-2020/ongoing element
7. Research	a. Improve characterization of direct and avoided GHG emissions from composting and anaerobic digestion and from compost use	Short term/late 2013-2014
	b. Investigate and determine the most suitable uses for digestate from anaerobic systems	Long term/2015, ongoing through 2025
	c. Support research and development projects demonstrating best management practices for composting, anaerobic digestion, and remanufacturing of non-organic materials such as carpet, plastics, and construction materials.	Long term/2015, ongoing through 2025
	d. Pursue research into development and commercialization of emerging biomass conversion and thermal technologies	Long term/ongoing through 2025
	e. Conduct additional research for safe and beneficial uses of MSW/ biomass ash and biochar	Long term/2025
	f. Investigate carbon sequestration and water savings potential of compost use in agricultural settings including irrigated croplands, rangelands, and natural lands.	Short term/2014-2020
	g. Evaluate possible research to improve understanding of landfill gas collection efficiencies	Long term/ongoing through 2025
	h. Conduct statewide characterization of landfill methane emissions and criteria pollutants by best available direct measurement methods and validation of inventory models	Long term/ongoing through 2025
	i. Support research and demonstration projects for methane capture equipment and technology to convert it to commercial LNG	Short term/ongoing through 2025
8. Cap and Trade	a. Consider use of Cap and Trade auction funds for infrastructure development	Short term/late 2013/early 2014
	b. Review benchmarks for capped recycling and remanufacturing facilities. Determine if Cap-and-Trade program can incentivize greater use of recyclable, organics, or other materials that are currently landfilled.	Short term/late 2013/early 2014
	c. Determine status of MSW-Thermal facilities in Cap-and-Trade	Short term/late 2014
	d. Review landfills for inclusion in Cap-and-Trade	Short term/late 2014
	e. Investigate opportunities to incentivize greater use of recyclable materials at facilities under Cap and Trade	Short term/late 2014

9. Regulatory and Statutory	a. ARB and CalRecycle should lead the development of program(s) to eliminate disposal of organic materials at landfills. Options to be evaluated will include: legislation, direct regulation, and inclusion of landfills in Cap-and-Trade. If legislation requiring businesses that generate organic waste to arrange for recycling services for that waste is not enacted in 2014, then the ARB, in concert with CalRecycle, will initiate regulatory action(s) to prohibit/phase out landfilling of organic materials with the goal of beginning compliance actions in 2016.	Short term/2014-2015
	b. Investigate regulatory options to further reduce GHG emissions at landfills such as incorporating BMPs and establishing lower methane emissions standards	Short term/2013-2015
	c. Monitor and participate in potential regulatory changes that could address the cost, timelines, and other hurdles to interconnecting to the electricity grid. (See also 3i)	Short term/ongoing through 2020
	d. Investigate the feasibility and impact of not allowing the use of green waste Alternative Daily Cover (ADC) to count as diversion	Short term/2013-2020
	e. Consider mandatory organic waste recycling for large commercial generators; for small commercial and residential generators. (See also 9a)	Short term/2013-2014 (large), 2016-2017 (small, residential)
	f. Consider amending CalRecycle regulations for composting and anaerobic digestion of food materials and other highly putrescible wastes	Short term/2014-2015
	g. Evaluate/recommend amendments to SABRC statutes for State procurement (include more products with recycling or GHG implications; revise minimum percentages; include Community Colleges and University of California; require State contractors to meet same purchasing requirements as State agencies; establish enforcement mechanism for non-compliance)	Short term/2013-2020

Appendix C - Focus Group Working Papers

Natural and Working Lands Working Paper

Natural and Working Lands Sector can be a source of emissions, for instance when such lands are converted to other uses or are subject to fires, disease and pests, but the sector also can actively remove carbon dioxide from the atmosphere. Plants absorb carbon from the atmosphere and through photosynthesis it is stored in plant material and roots. Soils may also store carbon. Natural and working lands can be protected, restored, and managed to reduce GHG emissions and maintain and increase carbon storage. Such actions often provide other important environmental and economic benefits, including benefits to human health and opportunities for revitalizing rural economies. The 2050 Vision for the Natural and Working Lands Sector is to reduce GHG emissions and maintain and enhance the capacity of natural and working lands to store carbon. Work to achieve the 2050 Vision may encompass: policy efforts, strategic investments, continued research, conservation, restoration, improved management practices, and a commitment to monitoring, evaluating and adapting strategies over time in light of changing conditions and improved information. Achieving the 2050 Vision for natural and working lands will help create a more resilient California that is better prepared for climate risks such as more frequent and severe wildfires, changing water availability, and stressors on species and natural communities.

California is one of the most biologically diverse areas on Earth and features a wide variety of natural resources and landscape types such as forests, desert, grasslands, oak woodlands, wet meadows, and tidal marshes. This section of the Appendix describes in further detail opportunities to avoid emissions and maintain or enhance carbon sequestration associated with forests (including urban forests and greening programs), rangelands/grazed lands, and wetlands.

This paper does not encompass all the ways in which natural and working lands can help to reduce GHG emissions in the state. For instance, natural and working lands support renewable energy development including solar, wind, geothermal and hydroelectric projects; and reducing the carbon content of energy is a critical component of reducing GHG emissions in the state. Natural and working lands also offer opportunities to increase climate literacy that can catalyze actions to reduce GHGs. For instance, California Parks draw tens of millions of visitors annually and interpretive programs may offer opportunities to help convey climate risks and opportunities. GHG benefits that agricultural croplands may offer are otherwise discussed in the Agriculture section of this Appendix. Finally, GHG issues associated with oceans are not included in this discussion. Oceans have absorbed about one-third of the GHG emissions produced by humans in the industrial era, and this is leading to acidification of the ocean.[1] Current measurements of ocean acidification are larger in magnitude and more rapid than anything in the fossil record of the past 65 million years[2] leading to significant implications for ocean biodiversity, fishing, and food security. It is unclear whether the

[1] http://centerforoceansolutions.org/climate/impacts/ocean-acidification/

[2] Ridgewell, Andy and Schmidt, Daniela N., Past constraints on the vulnerability of marine calcifiers to massive carbon dioxide release, Nature Geoscience 2010 Vol: 3(3):196-200. DOI: 10.1038/NGEO755

ocean's capacity to store GHG emissions will diminish over time.[3] Oceans play a key role in the global climate system - as oceans store and move heat, absorb GHG emissions, and function as part of the global water cycle. Climate models predict more extreme weather - due, in part, to climate impacts on oceans; and some weather changes will in turn increase GHG emissions (e.g. from wildfires or increased energy demand).

Jurisdiction over California's natural and working lands is divided between federal ownership, state ownership, and both industrial-scale and smaller-scale private ownership. Differing ownership and jurisdictional types have significant implications for managing lands for GHG purposes and other benefits. These issues are further discussed in the subsections below on forests, rangelands/grazed lands, and wetlands. Coordination across ownership and jurisdictional boundaries will be necessary in order to reduce emissions and maintain or enhance carbon sequestration on natural and working lands in California.

There are several common issues and opportunities associated with managing forests, rangelands/grazed lands, and wetlands for GHG purposes: 1) timing elements, 2) maintenance and monitoring requirements, 3) continuing research needs and the need to refine strategies over time, and 4) associated other benefits ("co-benefits"). These issues and opportunities are further discussed below.

There are issues and opportunities to consider with respect to timing of activities to prevent emissions and maintain or enhance carbon storage associated with forests, rangelands and wetlands. Forests, rangelands, and wetlands are dynamic, natural systems that experience carbon fluctuations; plant and soil respiration (including the decomposition of dead plant material) releases carbon into the atmosphere.[4] In order to capture significant, long-term carbon trends associated with natural systems, it may be necessary to look at longer time frame, decadal data and projections in order to craft strategies for preventing emissions and maintaining or enhancing carbon storage capability. Activities to enhance carbon storage, such as reforestation or restoration activities, may require some time to fully realize carbon benefits. There may also be additional benefits beyond carbon that can only be realized if actions are taken relatively early with respect to the actualization of expected climate impacts; for instance, in some cases, restoring tidal wetland can offer flood protection that is able to keep pace with sea level rise through the growth of root mass over time - but such naturally growing flood protection enhancements are only possible if restoration activities are initiated early enough.[5]

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[3] McKinley, Galen , Fay, Amanda, Takahashi, Taro, and Metzl, Nicolas. Convergence of atmospheric and North Atlantic CO2 trends on multidecadal timescales . Available from Nature Precedings <http://hdl.handle.net/10101/npre.2011.5993.1> (2011).

[4] IPCC Fourth Assessment Report: Climate Change 2007, Overview of the Global Carbon Cycle, Section 7.3.1. http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch7s7-3.html

[5] *See* Green Infrastructure for the Global Warming Era: The Horizontal Levee Nature's Low Cost Defense Against Sea Level Rise, 2013. This report concludes that in the San Francisco Bay Area, a hybrid tidal marsh-flood protection system can be constructed to keep pace with sea level rise for several decades in

Activities to reduce GHG emissions and maintain or enhance carbon storage associated with forests, rangelands/grazed lands, and wetlands will require on-going maintenance and monitoring. Dynamic, living systems must be maintained over time, and programs or investments to support carbon activities associated with natural and working lands must include a maintenance component. Furthermore, monitoring to quantify GHG benefits and other performance metrics is important to verify program success, and to refine management techniques, the accuracy of carbon models, and any criteria that may be used for the strategic prioritization of various activities related to carbon and natural and working lands.

Climate science and management responses to address climate change are both rapidly evolving as new information and experience is gathered. This section of the Appendix describes some continuing research needs relating to natural and working lands that would support efforts to reduce emissions and enhance or maintain carbon storage. As noted above, and is the case with efforts to address climate change in most sectors, an iterative process that refines management techniques, models and strategies over time is recommended.

Efforts to avoid carbon emissions and maintain and enhance carbon storage in forests, rangelands/grazed lands, and wetlands may offer a wide range of additional environmental and economic benefits ("co-benefits") for the state. These co-benefits may include, but are not limited to: functioning to enhance water quality and quantity; potentially providing safeguards against risks like flood and erosion; providing habitat, refugia and corridors for species and natural communities that are increasingly stressed by climate change; offering enhanced recreational opportunities and tourism revenue; supporting bioenergy development; offering waste diversion opportunities; helping to reduce energy demand as a result of shading; improving air quality; and/or supporting job creation in rural communities. In order to prioritize among the many opportunities to enhance carbon benefits associated with California's natural and working lands, it may be appropriate to try to maximize associated co-benefits that support AB32 and other state policy goals. Since carbon storage is only one of many products and ecosystem services which California natural and working lands provide, activities to reduce GHG emissions and maintain and enhance carbon storage should be undertaken in a manner consistent with sustainable and ecologically sound practices in order to continue to safeguard California's natural heritage.

More specific discussions relating to forests, rangelands/grazed lands, and wetlands are included below.

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critical locations if construction begins immediately.
http://www.bay.org/assets/SLR%20Executive%20Summary_web2.pdf

FOREST SECTOR

INTRODUCTION

California has a vast forest land base (approximately 33 million acres, or almost one-third of the state) that has the potential to significantly offset GHG emissions (Figure 1). California's forests are diverse and have evolved under varying ecological conditions and adapted to a fire prone environment. The diversity of tree species includes many types of conifers (e.g. Douglas-fir, incense-cedar, white fir, coast redwood, giant sequoia) and also many types of oaks (e.g. blue oak, coast live oak, etc.) Coast redwood and giant sequoia, for example, are some of the largest and fastest growing trees on Earth and have tremendous potential to store carbon and offset GHG emissions (Figure 3).

The state's forests also include urban trees. Trees in urban environments, or 'urban forests', sequester carbon dioxide through growth, while also providing significant shading and other cooling benefits that reduce urban temperatures and energy needs. Urban forests can also help filter air pollutants and can help absorb rainfall which would otherwise run over streets and wash pollutants into nearby waterways that are already under increasing stress from climate threats.

The forest land base is divided between private and public management. Predominantly held by the federal government (over 57 percent), these forest resources are located on state, federal, and private lands (Table 1). This diverse mix of land owners means that coordination among the state, private land owners, and federal agencies will be important to the success of any comprehensive forest climate strategy in California. In addition to carbon storage this strategy must consider the broader range of environmental services that forests provide (e.g. clean water, clean air, soil productivity, nutrient cycling, wildlife habitat, forest products, and recreation). Actions taken to address forest health concerns or to reduce wildfire risks may result in temporary reductions in carbon sequestration, but are necessary to maintain healthy forests that are efficient at GHG sequestration and more resilient to future climate conditions.

<u>Federal Lands</u>
Over half of the forest land base (approximately 19 million acres) and a substantial portion of the carbon sequestered in California's forests is on federal lands [1]. These lands support a range of management objectives and related environmental services. Forests on federal lands in recent decades have had less active management and tend to have a higher proportion of stands in older age classes. Previous research by USFS suggests that there could be substantial declines in carbon storage beginning in 2050 assuming the status quo for land management [2]. The decrease in carbon storage is a function of declining forest health; expect pest outbreaks, and losses from wildfire. To change the status quo state climate change strategies need to consider federal lands and broader forest health issues that extend beyond ownership boundaries. Since federal forests represent such a large and unfragmented part of the land base the

management choices for these lands are critical and represent an enormous opportunity to enhance climate benefits from a public resource.

Private and NGO Lands

Private lands are also managed for different objectives, but can largely be categorized by commercial timberlands, non-industrial, and NGO lands. Private timberland owners have more actively managed stands. Through timber harvesting forest stands on these lands may show periodic reductions in carbon stored in aboveground biomass. However, depending on the silvicultural prescriptions and resulting wood products private timberlands can maintain healthy forest stands that provide sustained climate benefits.

Private Non-Industrial forests have much broader management objectives. They tend to have less active management and owners manage smaller tracts of land. A recent landowner survey found that owners value their lands for natural amenities as well as a financial investment [3]. Larger landowners (e.g. > 500 acres) were much more likely to manage the land to produce income, but also more interested in environmental improvements.

There is a small but growing group of forest managed by non-government organizations (NGOs). Management tends to have a conservation objective that provides climate benefits and other co-benefits. Lands managed by NGOs have begun to utilize existing forest protocols that create additional revenue streams for lands managed to create additional climate benefits.

CLIMATE CHANGE – Environmental Effects on Forests

Climate can greatly influence the dynamics of forest and range ecosystems. Climate influences the type, mix and productivity of species. Future climate change scenarios predict increases in temperature, increases in atmospheric CO2 concentrations, and changes in the amount and distribution of precipitation [4]. Altering these fundamental drivers of climate can result in changes in tree growth, changes in the range and distribution of species, and alteration to disturbance regimes (e.g., wildfires, outbreaks of pests, invasive species).

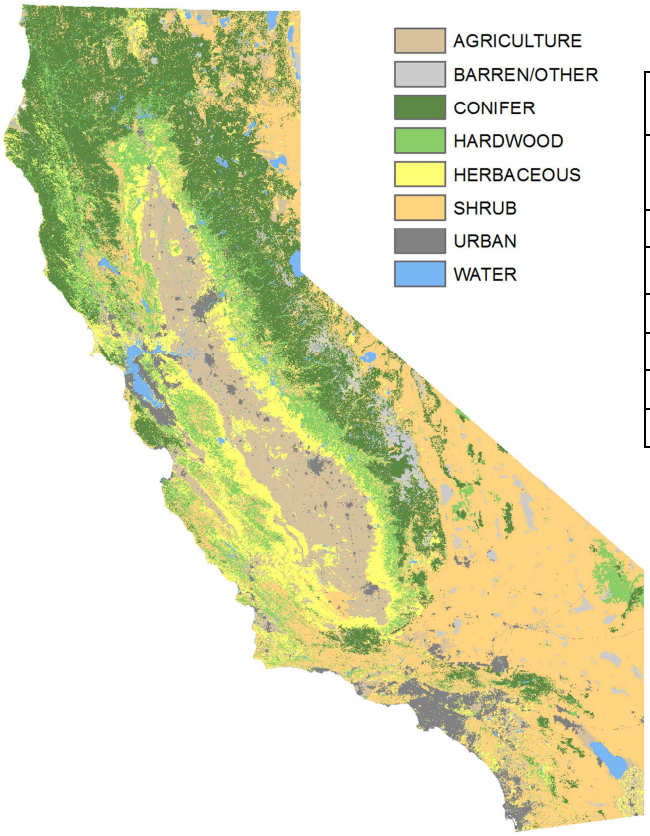

Table 1. Acres of Forestland by Landowner Group [1]

Ownership Category	Acres of Forestland	Percentage
Private	13,01,000	39.3 %
NGO	115,000	< 1%
Federal	19,171,000	57.4 %
State	711,000	2.1 %
Local	374,000	1.1 %
Total	**33,387,000**	**100 %**

Figure 1. Land cover map of California. Conifer and hardwood forest combined comprise approximately 33 million acres across the state. The corresponding table (Table 1) shows forest land ownership [1]

Given the long lifespan of trees in a forest stand, from decades to thousands of years, the effects of climate change on disturbance regimes may become apparent prior to noticeable changes in forests. These include changes in the timing, frequency and magnitude of wildfires; pest infestations; and other agents of disturbance (Table2) [5]. While disturbances occur regularly in nature, large changes in the patterns of disturbance could make forests less resilient. Vegetation types with restricted ranges may be more vulnerable than others, as well as areas that are already under stress from land use (i.e., expanding wildland urban interface) and management [6].

The influence that climate has on disturbance regimes may already be having an effect on forests. In California, extended drought and earlier snowmelt are leading to longer and drier summers with more pronounced fire activity. Relatively small changes in temperature and precipitation can affect reforestation success, growth, susceptibility to pests, and forest productivity.

Table 2. Climate change impacts in the forest sector [1]

FACTOR	DESCRIPTION
Hydrologic	Changes in temperature, precipitation, and hydrologic processes (i.e. decreased snow pack, earlier spring runoff, lower summer base flows).
Fire	Changes in the extent and frequency of disturbances from wildfires, pests, and disease outbreaks.
Biologic	Conditions may favor the spread of invasive species.
Biologic	Tree species expected to move northward or to higher altitudes.
Biologic	Changes in reforestation and regeneration success.
Biologic	Changes in forest productivity affecting growth and carbon storage. The effect of additional CO2 on forest productivity is uncertain.
Economic	Economic impacts from increased fire damage and fire suppression costs.

Climate Change Effects on Wildfire

Most forest species in California have evolved in fire prone landscapes and as such, wildfire plays a critical role in maintaining ecosystem health. However, wildfires can also be destructive and pose significant threats to life, property, public health, infrastructure, and water quality. One outcome from decades of fire suppression has been that many forest stands have not burned as frequently as they had historically and resulted in substantial acreage across the state in a high fire threat condition (Figure 2).

Prior to Western settlement wildfires were thought to be much more extensive; burning 4.5% - 12% of the land base annually [7]. Based on historical fire records an average of 320,000 acres burned annually; though, average annual acreage burned has increased to 598,000 acres between 2000 and 2010 [1]. Wildfires represent a source of GHG emissions. Current estimates on average annual emissions from wildfire are 24 million metric tons CO2/year [8].

Research has provided estimates of expected changes in wildfire activity resulting from climate change [9]. Results from this research predict an extended fire season with a substantial increase in wildfire acres burned. Early studies [10] showed only a modest increase in wildfire acres burned (9 – 15%) under a range of future climate scenarios. However, more recent modeling showed that the expected wildfire-burned forested area for Northern California, under a high emissions scenario, increased in excess of 100% [11]. The increased activity in number and extent of wildfires would likely result in significant increases in emissions from wildfire. In addition, research predicted outcomes that varied with fire regimes; where expected increases in temperature promoted greater large fire frequency in wetter forested areas [12].

Insects and Disease

Insects have been part of forest ecosystems through evolutionary history. Occasionally individual species populations will surge into sizeable outbreaks that can result in forest damage and tree mortality. Dead trees left from forest pests lose their ability to sequester carbon and can become prone to wildfires that increase carbon emissions and even further reduce the effectiveness of forests as carbon sequestration agents. The increase in fire hazard is mainly due to large volumes of surface woody fuels that accumulate as the trees fall apart over time, in conjunction with the understory vegetation growth that is stimulated by new sunlight making its way to the forest floor.

Climate change is expected to dramatically increase pest outbreaks across the state. Insect life history and distribution is largely defined by temperature and precipitation, and the current and predicted upward trend in temperatures particularly favors forest insects. In recent history we have seen these patterns when bark beetle outbreaks occurred during periods of drought. Foliar pathogen outbreaks, such as Sudden Oak Death, have occurred during years when precipitation has been high and late in the season [13]. Insects also have the ability to travel into new ranges which will give them an advantage in changing climate conditions over their more slowly distributing tree hosts.

Based on the USFS Forest Health Monitoring Program predictive potential risk model of insect and disease related forest mortality, nearly 5 million acres are at high risk. The USFS 2011 mapping efforts surveyed 42 million acres across the state, and over half a million acres showed mortality [13].

Figure 2. Map of fire threat. Areas of orange and red represent high and very high fire threat respectively [1].

<u>Forest Health – Restoration Needs</u>

Following decades of fire suppression many forest stands, particularly across the Sierra, are overstocked with small trees and high fuel loads that are at risk to high severity fire and insect/disease outbreaks. Stand improvement and forest fuel reduction treatments are intended to compensate for historic disturbance cycles and make these forests more resilient. Recent study estimates that almost 3 million acres across the Sierra would benefit from fuel reduction treatments [14].

FOREST CARBON ACCOUNTING

There is much interest in the role that forests (natural and urban) can play in offsetting GHG emissions. Forest ecosystems are a major part of the carbon cycle; taking in carbon dioxide (CO2), storing carbon as part of its woody biomass (including long after harvest in certain forest products), and releasing oxygen back into the atmosphere. Given the diversity of tree species there is great variability in carbon sequestration among different forest types. Mixed conifer forests, found broadly across the Sierra and Cascades, have been estimated to store 60 tons of carbon per acre [15]. In addition, redwood forests are unique to California; their high growth rates and large size have great potential for biomass and carbon sequestration (Figure 3). Carbon storage for

Redwood forests have been estimated at approximately 150 tons per acre [16]. Through wildfire, mortality, and other forms of disturbance there is a natural cycling of carbon between forests and the atmosphere. Given enough time, healthy forests are resilient and will recover and regain carbon lost through disturbance. Understanding how forest carbon pools are affected by land management and natural disturbance regimes is an emerging field of science, requiring extensive data collection and complex modeling approaches [17] [18]. Our current capacity to comprehensively measure all pools of carbon is limited [19] [20] [21]. Although some studies have been done it is an area where additional research is needed to refine methods and fill data gaps [22]. The breakdown of carbon stock (i.e. pools) include quantification of living biomass (above and below ground), dead organic matter (litter and debris), soil organic matter, and wood products (Figure 4).

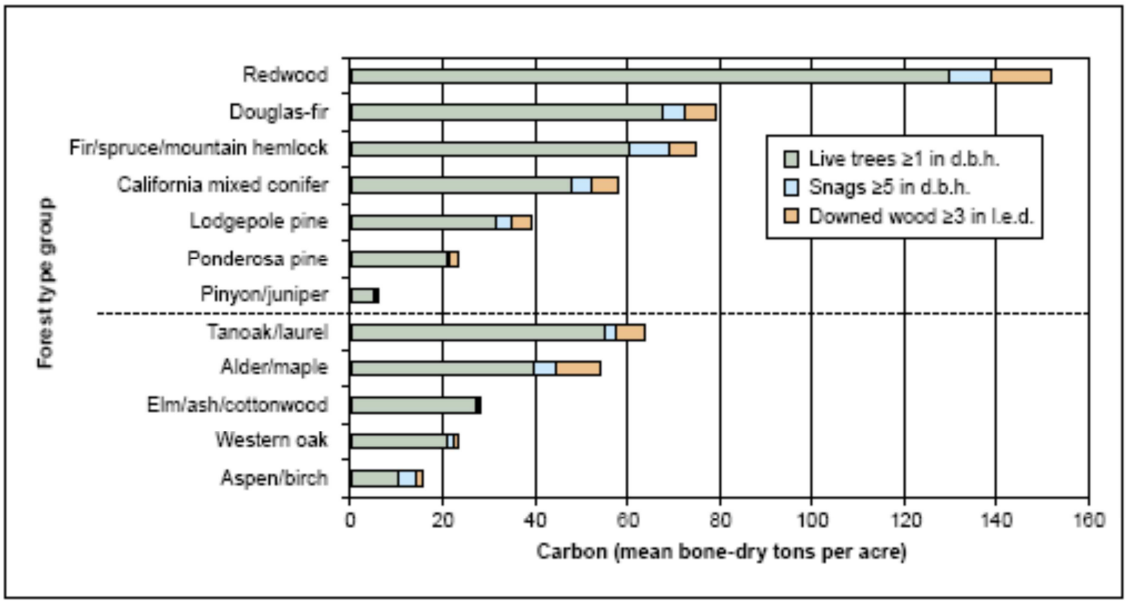

Figure 3. Estimates of carbon storage by forest trees in California [16]

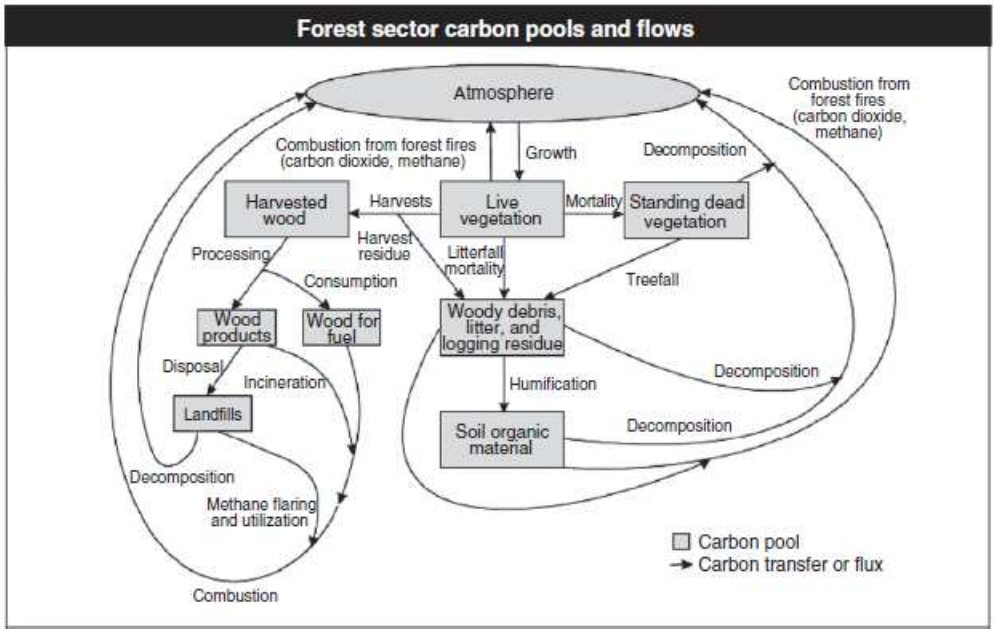

Figure 4. Forest carbon sequestration cycle. Heath et al. 2003 [23] cited in Sedjo and Sohngen 2012 [24].

Urban forests are an important part of the forest sector and like wildland forests, urban forests are also contributors to carbon sequestration and storage. There are around five million acres of urban area in California, which is around 5% of California's land base, and urban area is projected to increase to 15% by 2050 [25]. Within that urban area, average tree cover throughout California's urban area varies greatly between counties, cities and communities. The average tree cover for a California urban area has been estimated at 6.7%, yet there is likely to be substantial variability[25]. For example, Sacramento has an estimated tree cover of 13.2% [26]. Previous Air Resources Board (ARB) estimates of CO2 sequestration have not included urban tree canopy in their estimates. CALFIRE is currently working with UC Davis to create a statewide source of information for estimating CO2 sequestration in California's urban areas that will utilize existing tree inventories and canopy data to support the AB32 scoping report and other resource assessments.

<u>Past and Current Studies</u>

Previous studies have mostly estimated forests in California to be operating as a carbon sink [27]; but are predicted to slow over the next century [28], [29] [30]. This pattern of slowing carbon storage is similar to a trend shown nationally (figure 5). Methods for estimating forest carbon and emissions are still relatively new and are an active area of research. This is reflected in the broad estimates that range from an annual sink of 66.4 MMT CO2eq to a potential source of 55 MMT CO2eq for studies evaluating conditions between 1990 and 2010.

Initial estimates reported in the 2008 AB32 Scoping Plan estimated annual forest sequestration at 5 MMT CO2eq [31]. In 2010, CALFIRE estimated net forests carbon sequestration at 30 MMT CO2eq (Table 3) [1]. National estimates for California's forests have been even higher. USDA estimates 66.4 MMT CO2eq/yr sequestered by CA forests in 2008. This finding is based on GHG inventory data from 1990 – 2008

[32]. Between 1994-2000 California Energy Commission funded a study that estimated that forests and rangelands in a limited study area were sequestering 7.55 $MMTCO_2eq/yr$ [33]. Using a vegetation dynamics model NASA researchers estimated that in above average precipitation years (1990-2004) forest carbon pools may offset between 52and 86 MMT CO2eq/yr ; and estimated that forests could be a source of up to 55 MMT CO2eq/yr in a dry year [27]. An additional study that looked at the impact of climate change on California ecosystem services also founds forests to operate in a similar range of 13 $MMTCO_2eq/yr$ [34]. There have been limited studies to estimate carbon sequestration of forests in urban area. California urban forests contain about 36 MMT of carbon, and remove about 4.4 MMT CO2 from the atmosphere annually.[25].

Given the wide range of carbon estimates and consistent with the emphasis of this Scoping Plan Update to include all natural landscapes, ARB is currently working with University of California researchers to refine the carbon emission inventory for California forest, shrub, grassland, wetland, and desert vegetation land types. The deliverables will include an updated inventory utilizing FIA and other data sources in combination with remote sensing tools to expand, revise and update the carbon inventory. Consistent with the existing inventory elements, the new inventory will also include improved methods to account for carbon storage and emissions in wood products in use and in landfills. These sources of stored carbon need to be assessed relative to natural (e.g., wildfire, decomposition of dead material) and management-based emission sources.

In addition to development of an updated inventory, the University of California research team will also deliver a system tool to allow ARB staff to utilize the most current data and information to update the Sector Greenhouse Gas inventory. To assist with these efforts, CALFIRE, USFS, and other agencies have made substantial investments in collecting information on vegetation, wildfires, and management activities that, over time, can be used to assist ARB staff in refinement and improved accuracy of the GHG inventory.

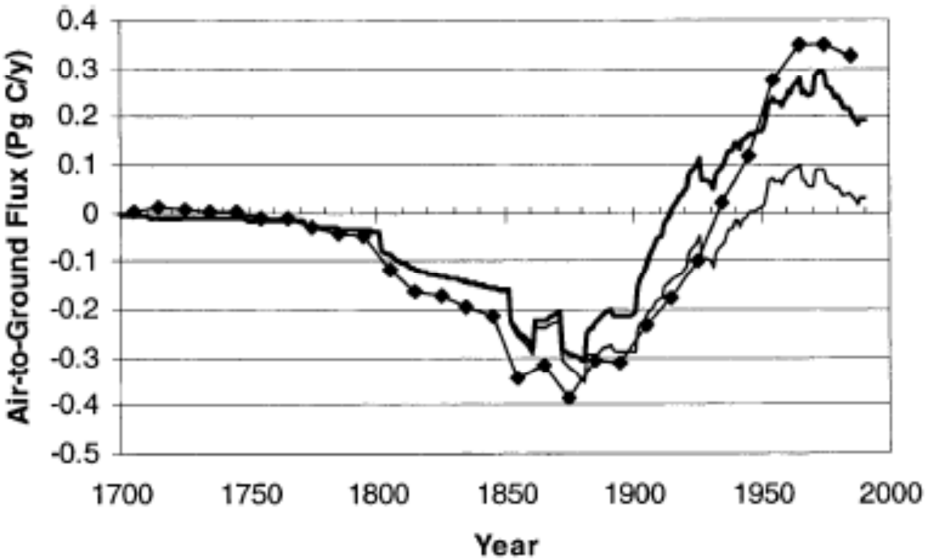

Figure 5. adopted from [28] this figure shows estimated average annual air to ground net flux in $Pg \cdot y^{-1}$ from 1700 to 1990. Positive values indicate a land sink and negative values indicate a source to the atmosphere. Light line, ref. 6 without fire suppression. Dark line, ref. 6 with fire suppression. Dark line with dots is the results from a mechanistic ecosystem demography model.

Monitoring Challenges

Given the complexity of forest ecosystems and inter-annual variability in carbon fluxes there is an on-going need to invest in monitoring to refine baseline and future estimates for forest carbon. The most critical component of monitoring forest carbon in California is the continued long-term commitment to collect forest inventory plot data through FIA (Forest Inventory Analysis). FIA is a federal U.S. Forest Service program that provides a statistically rigorous sampling of forest stands across the country that can be used as a core part of a forest carbon inventory. However, FIA was initially developed to track changes in commercial timber resources and has only in recent years been refined to provide additional measurements for estimating forest carbon [18]. Carbon monitoring has brought an additional level of complexity to commonly measured variables since below ground and forest floor variables are of interest and are spatially heterogeneous [35]. Estimation of all of these variables occurs amidst the backdrop of natural ecosystem dynamics/disturbances, and human caused disturbances.

USFS FIA was traditionally limited to lands with undisturbed understories, which excluded urban areas. However, the USFS recognizes the critical role that urban forests play, and have a pilot project to include urban forests in the National FIA program, and California is included in the project. These data will be helpful in measuring carbon storage in areas that have traditionally been overlooked because of urban challenges including a wide variation in species, climate, tree diameter and density, and different irrigation regiments. These variations occur widely across single communities and counties, adding potential error to statewide urban canopy carbon

estimates. These estimates can improve through further field data collection; increasing the density of FIA plots and expanding monitoring of all carbon pools [26].

In addition to field inventory data (e.g. FIA) recent carbon accounting methods are being developed to link plot data to vegetation maps derived from remote sensing. This is a promising area of research to provide a detailed spatially based estimate of forest carbon. LiDAR data in particular has shown to provide extensive information on tree height, canopy, and other structural elements. However, there are ongoing challenges associated with both data and methods that require additional refinements to improve the accuracy of carbon estimates.

There are also challenges associated with estimating emissions from wildfire, tree mortality from pests and other forest health issues. Ongoing investments both in monitoring data and analysis procedures are needed.

MITIGATION STRATEGIES & CO-BENEFITS

The recommendations herein are consistent with the 2008 AB 32 Climate Change Scoping Plan, which identified the following forestry sector opportunities for additional greenhouse gas (GHG) reductions:

- Afforestation and Reforestation
- Forest Management
- Urban Forestry
- Forest Conservation
- Fuels Management
- Forest Materials & Bioenergy

The following section provides a brief description and examples of these strategies and highlights the many co-benefits associated with forest sector strategies.

An analysis by CAL FIRE [1] indicated that status quo management of forestlands in the state would sequester over 30 MMCO2E (net) over a ten-year period. Investments in additional forestry sector projects have the potential to assure that this level of net sequestration is attained (e.g., through reduction of fire threat and addressing forests pests) or exceeded (e.g., through projects that will increase the rate of net sequestration). While more work is needed to refine quantification of the GHG benefits and costs of forest sector projects, it is clear that these projects have significant potential to sequester carbon and reduce emissions. Further, forest sector projects provide multiple and substantial co-benefits.

Investment opportunities in the forest sector generally fall into one of the 6 categories detailed below. In some cases there are a number of entities with established programs and expertise to deliver on-the-ground GHG reduction projects, though current program funding is in most cases significantly below historic levels and is a barrier to achieving

the potential levels of GHG reductions. See Enabling Programs, below, for implementation.

Forest Conservation – Tools available to prevent or mitigate conversion of forestlands to more developed uses include land use planning, conservation easements, and mitigation banking. Working Forest Conservation Easements (WFCEs) are an important legal tool to secure existing and future forest carbon stocks from loss due to development. Specifically, WCFEs prevent the conversion of forests to other uses (thereby avoiding the release of sequestered carbon). They also require maintaining or increasing carbon stocks over time while guiding management to improve wildlife habitat and watershed health. Furthermore, WFCEs help ensure that our forests will always be a source of logs for California's lumber mills and woody materials for bioenergy—thereby helping maintain forest sector employment.

The co-benefits of WFCEs include:

- Improved forest management, including site-specific conservation prescriptions, and support for adaptation;
- Watershed conservation to maintain water sources;
- Retention of actively managed timberland to sustain the forest-products industry in perpetuity.

Forest Management– Many of California's forests, notably those held by smaller forestland owners and lands managed by the US Forest Service and other public agencies, are unnaturally dense due to decades of fire exclusion and minimal levels of management. Hundreds of thousands of acres of forest are in need of thinning and removal of fire-prone vegetation, or in need of treatment to address insect and disease conditions. These areas would accumulate carbon more quickly and be more resilient to disturbance factors of fire and pests if they were returned to a healthier, natural condition.

The co-benefits of improved forest management include:

- Accelerating the creation of older forest conditions;
- Creating renewable energy through biomass utilization;
- Reducing the near-term intensity of wildfires and the corresponding property damage and carbon emissions;
- Reducing fire suppression risks and costs, and;
- Creating immediate jobs in the woods in in rural parts of the state that have long faced economic disadvantages.

Fuels Management— Large portions of California have forests that are at very high risk of wildfire, and many of these forests are at increased risk because of high fuel loads resulting from past management actions and a legacy of fire suppression. Investments in fuel reduction projects can help reduce the intensity of fires, making forest carbon stores more stable by increasing the resiliency of the forest to the inevitable wildfire. The near-term carbon emissions associated with the thinning can be reduced if the waste material is used at a local biomass facility to generate energy.

Fuel treatments have a proven track record of reducing costs and losses associated with wildland fires. These include wildland fire suppression costs to federal, state, and local governments.

Reforestation and Afforestation – Replanting areas that were formerly forested or are currently under-stocked offer significant carbon sequestration opportunities, especially over a longer time horizon. Areas of opportunity include conifer forests not reforested after severe fire, as well as riparian hardwood reforestation at lower elevations. Opportunities are present on both private and public forestlands.

The co-benefits of reforestation include:
- Improved watershed health; and
- Significant employment opportunities.

Urban Forestry – More than 94% of Californians live in an urban area and depend on the multiple ecosystem, social, and economic benefits of urban forests. Urban forests reduce atmospheric carbon by locking up CO2 in their roots, trunks, stems and leaves while they grow and by reducing heating and air conditioning demands reducing emissions associated with power production [36]. Maintaining existing urban forests sustains current carbon sequestration benefits while planting more trees offers significant new GHG reduction opportunities that will increase over time. Urban forests also improve air and water quality, provide local jobs, reduce residential energy consumption, and benefit disadvantaged communities.

The co-benefits of urban forestry include:
- Increasing shade that reduces heat island effect, lowers cooling bills, and saves energy;
- Strengthening property values;
- Improving air and water quality;
- Creating jobs planting and maintaining trees; and
- Improved water quality and reduced stormwater runoff.

Forest Bioenergy -- Converting forest biomass to energy presents both challenges and opportunities. If produced in a sustainable and efficient manner, wood fuel can be a renewable, at least partially carbon neutral source of energy. Some of the potential benefits of utilizing woody biomass fuel include improved forest health, reduced risk for wildfires, enhanced silvicultural opportunities, avoidance of GHG emissions, and diversion of urban wood waste from landfills. Forest biomass conversion to energy is compatible with a variety of land management objectives that include wildfire control, forest health and commercial timber management. While the bulk of industrial fuel wood today comes from residues left over from commercial harvest operations, additional supply could come from noncommercial thinning, post-fire salvage, fuels reduction residues, and urban forest materials. Currently, throughout California biomass energy provides 2.4 percent of all electricity used [37]. Approximately half, or 1.2 percent, comes from forestlands.

The co-benefits forest bioenergy include:

- Forest health can be improved by the timing and intensity of thinning, stand spacing, rotation length, and site preparation [38]
- Fuel treatments can reduce wildfire intensity and likelihood in residential communities [39].
- Selling low quality wood and fostering better quality higher grade timber provides enhanced silvicultural opportunities [40].
- Provide alternatives to pile burning which releases carbon and other air pollutants directly into the atmosphere without the benefit of capturing the energy [41].
- Potential additional terrestrial carbon created which reduces emissions and provides climate benefits [42, 43].

RESEARCH NEEDS FOR WILDLAND AND URBAN FORESTS RELATED TO CLIMATE CHANGE

The fundamental focus of the research needs discussed in this section is to enhance monitoring and develop a better understanding of forest and woodland ecosystem dynamics. Further, the proposed research needs are intended to promote research that leads to managing forests in a sustainable manner that enhances forest carbon and related ecosystem services. See the Climate Research Needs report and the State Adaptation Plan for additional information on research needs for the forest sector.

- Improved tools and on-going research for monitoring and modeling and to better understand baseline conditions, processes, and projected trends in forest resources, carbon flux and climate related changes.
- Continue and enhance FIA plot data collection. Develop analytical tools to integrate the urban FIA data results into planning and policy decisions.
- Track human related and natural forest disturbances and create and maintain a central, accessible database.
- Utilize public forest lands for a weather station network and conduct long-term monitoring to better understand the relationship between climate and forests.
- Utilize paleoecology to better model and understand climate and vegetation dynamics.
- Reduce uncertainties in forest climate modeling and increase understanding of threats to forest carbon, including those posed by fire, insects, disease and invasive pests.
- Benefit-cost analysis on actions to maintain or enhance forest carbon and other ecosystem services.
- Further research to assess the influence on climate change on forest health and productivity.

FOREST SECTOR – POLICY FRAMEWORK

<u>Interagency Forest Working Group (IFWG)</u>

Pursuant to the initial Scoping Plan,the California Natural Resources Agency (CNRA) through the Board of Forestry and Fire Protection established the Interagency Forestry Working Group (IFWG) to address a broad range of climate change issues. The

purpose of the interagency committee was to provide recommendations and technical information to assist the Board in achieving the Board's goals and objectives as outlined in the Board's report to the Air Resources Board on AB32 and in relation to the climate adaptation strategies. Three primary tasks were identified by IFWG:

1. Update the California GHG inventory for the forest sector (ARB lead)
2. Evaluate adequacy of existing forest regulations and programs to achieve Scoping Plan forest sector GHG targets (CALFIRE and USFS lead)
3. Define biomass sustainability for biomass and biofuel utilization (CEC lead)

The Board of Forestry and the California Natural Resources Agency co-chaired the IFWG with participation from seven other departments and agencies including:

California Environmental Protection Agency
Air Resources Board
California Department of Fish and Wildlife
California Energy Commission
Department of Water Resources
CAL FIRE
U.S. Forest Service

There has been significant work on the GHG emissions inventory for forests since the initial Scoping Plan. Preliminary results show that healthy forests can be an important source of sequestration; however, loss of forests through fire and conversion to other uses can release significant CO2. California forests must be managed to ensure that they provide net carbon storage even in the face of increased threats from wildfire, pests, disease, and conversion pressures. Planning targets for ensuring net carbon sequestration, must also ensure forest resilience, health, and continued ecosystem services. Developing such planning targets may require a resource economics study, and funding for such a study will be needed. Implementation of forest climate planning targets will require adequate and sustainable funding sources that will need to be identified.

ENABLING PROGRAMS

CAL FIRE's programs involve collaboration with many other government entities (federal, state, local), private land owners, and nongovernmental organizations. The following programs are established to enhance the range of environmental services that forests provide, including climate benefits:

- Urban and Community Forestry Program
- California Forest Improvement Program
- Vegetation Management Program
- Forest Legacy Program
- Forest Pest Management Program
- Reforestation Services Program

More information on these programs is available at:
http://calfire.ca.gov/resource_mgt/resource_mgt.php

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RANGELAND/GRAZED LAND

Introduction

In California, there are about 33.6 million acres of grazed land (19.2 million acres of privately held and 14.5 million acres of publicly owned grazed forest and rangeland), comprising about one third of the land in the state (Table 1; Figure 1). Additional grazing occurs on extensive desert shrub land. Unless otherwise noted, desert shrub land is not the focus of this discussion. Eight of California's 12 major drainage basins are dominated by vegetation types that are commonly grazed rangeland. This represents roughly twenty ecosystems in California, and a rich diversity of species. Rangeland plays a key role in ensuring watershed function in California. The location of rangeland, between the forested areas and major river systems, means that almost all

surface water in California passes through rangeland. Two-thirds of the major reservoirs in the state are located on public and private rangeland. As such, grazed land "green" infrastructure is a cost-effective way of protecting and maintaining healthy watersheds in California. This is accomplished through rangeland conservation programs that aim to secure beneficial land uses through conservation easements and best management practices, in order to protect both water supplies and water quality. Another important set of benefits of rangeland include the natural ability to sequester and store carbon in the plant material and soil.

While rangeland in California is, overall, close to neutral with respect to GHG emissions, a significant mass of carbon is sequestered in rangeland soils throughout the seasonal flux (Kroeger, T., et al. 2009. An Economic Analysis of the Benefits of Habitat Conservation on California Rangelands. Defenders of Wildlife. 91pp.) (USDA. Technical Bulletin 1930.2011.USDA Agriculture and Forestry Greenhouse Gas Inventory: 1990-2008.115pp.). In addition, there is considerable potential to increase sequestration through simple, well known land management practices (Kroeger, T. et al. 2009.). For annual grassland, the greatest benefits in sequestration enhancement are associated with restoration of riparian corridors, restoration of perennial grassland, and control of invasive plant species. For oak-woodland/savanna type rangeland, the greatest benefits in sequestration are associated with restoration of woody species. Finally, for chaparral rangeland, the greatest benefits are associated with control of invasive plant species and management of expanding shrubs and trees (USDA. 2011). These enhanced management approaches, while beneficial for a variety of other ecosystem services, such as species richness and water quality protection, are not generally of significant economic benefit to land managers producing food and fiber through animal grazing. To realize the greatest benefits, incentives or cost shares are often necessary, to induce management practices with multiple social/environmental benefits.

Grazed land soils emit both nitrous oxide and methane, which result from increased available nitrogen and manure off-gassing (USDA.2011.). Rainfall, soil moisture, and intensity of grazing all have an influence on the variability of GHG flux and net capacity in a given timeframe. However, since grazed land is, in general, not plowed, there is still little net emission of GHGs from rangeland. USDA calculated that in 2008, nationwide, 96% of GHG emissions from grazed land were nitrous oxide, methane making up the other 4%. Conversely, grazed lands were a sink for carbon. In some years, the mass balance trends toward carbon sequestration, while in other years the mass of nitrous oxide and methane emissions exceeds that of carbon sequestration (ibid).

In California, between 1984 and 2008, an average of 16,105 acres of rangelands was converted every year, primarily to urban and irrigated agriculture uses (California Department of Conservation. 2011. California Farmland Conversion Report 2006-2008. State of California. 108pp.). Climate change will pose a new threat to rangelands by changing water availability and species distributions. Climate modeling scenarios showed that a loss of rangelands will lead to loss of biodiversity, impaired water quality, less carbon sequestration, less groundwater recharge, and in some cases, less input to

food production (Kroeger, T., et al. 2009.). Ecosystem services (resources and processes supplied by natural ecosystems) provided by rangelands include wildlife habitat, groundwater recharge, and carbon sequestration. Recent studies have attempted to assess potential threats to rangeland ecosystems services and to quantify the economic costs and benefits. The key threats for ranching in the future include limited availability of grazing land for lease, fragmentation of grazing land, declining forage quality and quantity, and high start-up investment cost. The expanse of rangeland in California offers significant potential for increased carbon sequestration. While recent publications have begun to address the specifics of carbon sequestration in California landscapes (Silver, W., R. Ryals, and V. Eviner. 2010. Soil Carbon Pools in California's Annual Grassland Ecosystems. Rangeland Ecol Manage 63:128-136.) (Silver, W., M. DeLonge, and J. Owen. 2013. Climate Change Mitigation Potential of California's Rangeland Ecosystems. DESPM, University of California, Berkeley. 30pp.) most of the studies of rangeland carbon sequestration have been conducted outside California. A comprehensive assessment of such opportunities needs to be conducted (PIER. 2003. California Energy Commission Contractor/Consultant Report. Attachment IV – Carbon Sequestration in California's Terrestrial Ecosystems and Geological Formations. 48pp.)

Table I. Area of land cover by owner group (acres in thousands) (From FRAP 2010)

WHR Vegetation Type	Private	USFS	BLM	NPS	Other Public	NGO	Total[1]
Forestland							
Conifer Forest	6653	10762	346	1106	434	34	19335
Hardwood Forest	2828	1305	194	104	151	12	4594
Forest and Rangeland							
Conifer Woodland	466	989	469	317	137	21	2399
Hardwood Woodland	4296	284	193	19	456	45	5295
Rangeland[2]							
Shrub	4842	5806	2353	282	1180	60	14522
Herbaceous[3]	9525	376	433	82	831	159	11407
Desert	3540	137	10450	4772	4325	27	23251
Total Forest and Rangeland	**32151**	**19658**	**14438**	**6682**	**7512**	**358**	**80799**
Other							
Agriculture	11336	3	39	1	237	24	11639
Barren/Other	358	841	428	760	324	3	2714
Urban	3897	6	27	5	221	3	4159
Water[4]							1916
All							
Total	**47742**	**20508**	**14932**	**7449**	**8294**	**387**	**101227**

1 Totals may not add up due to rounding
2 Rangeland refers to “primary” rangeland, and does not include conifer forest, which has rangeland forage potential and is often grazed by livestock
3 Includes wetlands
4 Areas classified as water are not assigned an ownership
USFS – United States Forest Service, Department of Agriculture
BLM – Bureau of Lands Management, Department of the Interior
NPS – National Park Service, Department of the Interior
NGO – non-governmental organizations (e.g., The Nature Conservancy)
Data Sources: California Protected Areas Database, GreenInfo Network (2009); Statewide Land Use / Land Cover Mosaic, FRAP (2006)
(California Department of Forestry and Fire Protection Fire and Resource Assessment Program. 2010. California’s Forests and Rangelands: 2010 Assessment. Sacramento, California.341pp.)

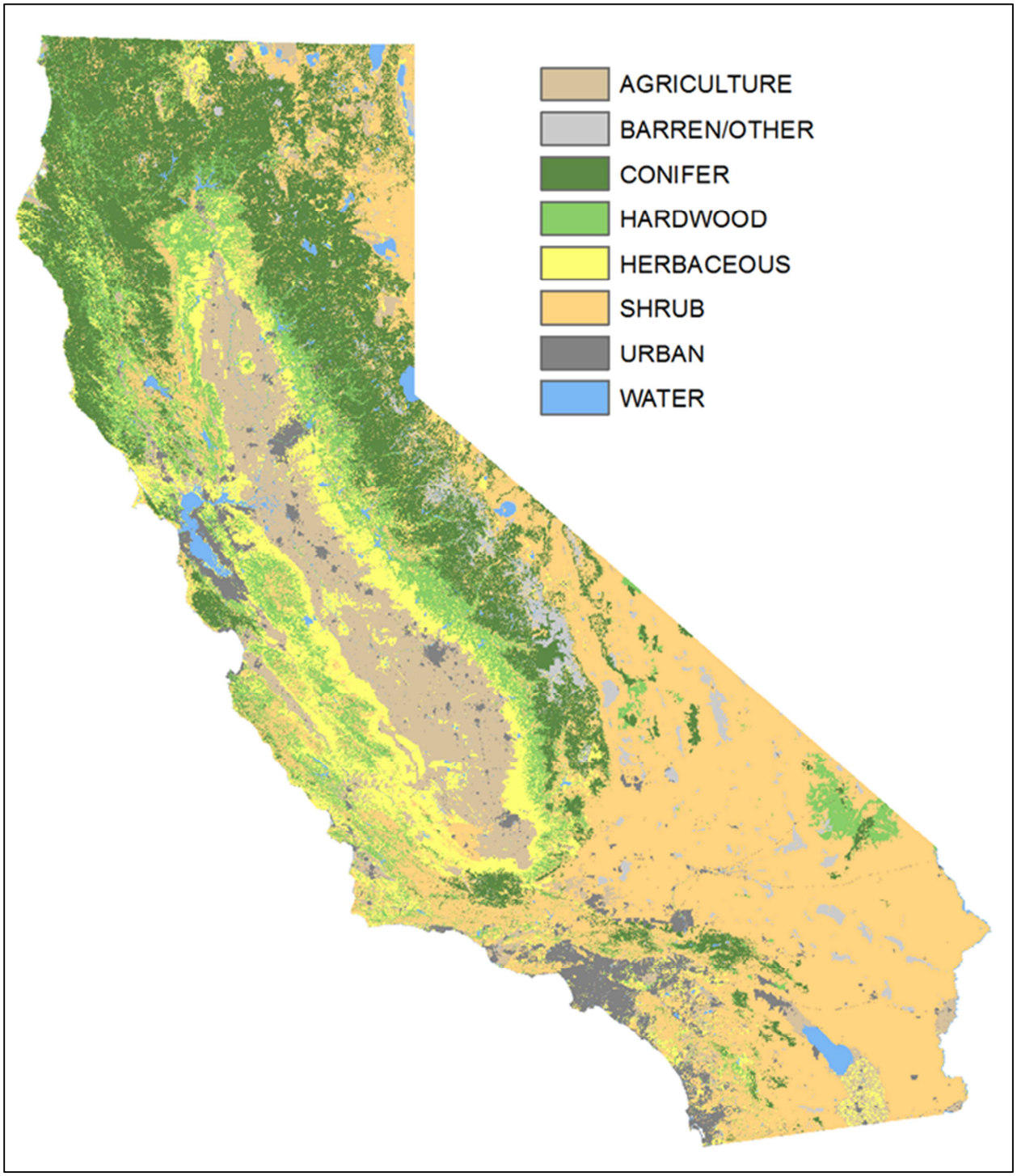

Figure I. Distribution of land cover by type (Derived from CDFFP FRAP 2010)
(CDFFP FRAP. 2010.)

Issues and Opportunities

Grasslands, globally, account for about one-third of stored soil carbon (Silver, W., et al. 2013). Carbon sequestration in rangeland results primarily from forage vegetation growth (ibid). Additional soil carbon sequestration can occur through additions of manure and compost, with a related increase in emission of nitrous oxide and methane (ibid). Rates of carbon sequestration are sensitive to precipitation, with higher precipitation leading to greater soil moisture, increased plant growth, and increased levels of soil carbon (ibid). California precipitation is temporally and spatially highly variable, with modeled future scenarios showing a likelihood of increased variability (ibid). This underscores the need for more complete and ongoing assessment of statewide potential for enhanced management of rangelands for increased sequestration of atmospheric CO_2, where feasible.

Recent publications estimate that there is significant potential to increase annual rates of carbon sequestration in California rangelands through soil amendment, perennial grass enhancement, and tree planting, particularly within the savannah woodland systems (Silver, W., et al. 2013) (Ryals, R. and W. Silver. 2013. Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands. Ecological Applications, 23(1), 2013, pp. 46 – 59.) (Silver, W., et al. 2010) Silver et al have calculated that rangeland management carbon sequestration projects implemented on about 28 million acres of the existing rangeland in California could yield increased carbon sequestration of between 21 and 42 million metric tons per year. For comparison, commercial and residential sourced GHGs are calculated to contribute about 42 million metric tons per year. While enhanced carbon sequestration is a promising potential future outcome, maintaining existing rangelands intact is also an important part of meeting future GHG emission targets.

In a recently published study of Yolo County prepared for the California Energy Commission's California Climate Change Center, researchers at the University of California, Davis, calculated relative contributions of GHG emissions from agricultural and non-agricultural land uses (Jackson, L., et al. 2012. Adaptation Strategies for Agricultural Sustainability in Yolo County, California. California Energy Commission. Sacramento. 189pp.) Conversion of agricultural land to other developed uses has been shown to increase GHG emissions by up to seventy times, compared to current emissions. For rangeland, conversion to urban uses is calculated to result in GHG emissions up to 217 times, compared to current emissions. Conversely, conversion of cultivated agricultural land to grazing land will result in an immediate, significant, permanent decrease in GHG emissions by a factor of about 66% per acre fallowed (Jackson, L., et al. 2012).

Conclusions

When rangeland is converted to developed uses, CO_2 emissions can be expected to increase significantly. Depending on the type of development, the increase in CO_2 emissions may be up to two hundred ten times that calculated to occur from average

rangelands (Jackson, L., et al. 2012). Existing sequestration rates exhibit a relatively neutral flux of GHG sequestration/emission, while showing reasonably significant potential for modified management activities, and resultant increased rates of sequestration. One of the greatest issues to consider when adding rangeland management to the GHG sequestration toolbox is the marginal financial returns to the land owner. There are not a lot of funds available within existing economics of livestock grazing to fund additional studies, to perform modified management for enhanced carbon sequestration, nor to measure and validate sequestration rates over the long-term. The state must take leadership in developing incentives and cost shares, to protect and enhance the extensive rangelands of California for the greatest benefit of current and future generations.

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WETLANDS

Introduction

The process of carbon capture and storage (sequestration) in the terrestrial biosphere, underground, or in the oceans is a mechanism to reduce the buildup of carbon dioxide (CO2) and other greenhouse gases (GHG) in the atmosphere for the purpose of reducing or slowing GHG-induced climate change. Reducing or slowing GHG emission is the central feature of California's landmark efforts to address global warming. A proven method of carbon sequestration is the use of land and water-based ecological systems to enhance the natural uptake of atmospheric carbon in plants and soil. Acquisition of land through voluntary transactions and the restoration of that land will help protect and expand carbon sequestration potential while working to meet our conservation goals for the state. Sound conservation and management efforts will not only provide direct sequestration benefits but will safeguard long-term sequestration investments.

Wetlands are prime candidates for these mitigation practices for a number of reasons. Wetlands, especially tidal wetlands, have great potential for carbon sequestration due to high levels of net primary productivity and low decomposition rates, meaning that a large amount of organic matter is accumulated annually (Miller et al., 2008). Wetlands can also serve as perpetual long-term sinks for carbon because they continually grow larger from deposition of organic matter and sediments and are therefore relatively self-sustaining over time. Additionally, wetlands have among the most efficient sequestration rates per unit area of all habitat types. That being the case, when wetlands are either converted or degraded they will emit large amounts of previously sequestered carbon (stored carbon), adding to existing GHG emission levels. For example, it was recently determined that global tidal marsh degradation/conversion has led to the release of up to 0.24 billion metric tons of CO2 per year at an estimated cost of 9.7 billion dollars (Pendleton et al., 2012). In the Sacramento-San Joaquin Delta (Delta), a recent study found that approximately 175–299 g-C m−2 yr−1 were emitted as CO2 and 3.3 g-C m−2 yr−1 were emitted as CH4 from a grazed degraded peatland (Hatala et al., 2012). Degraded wetlands also have lower sequestration rates than healthy systems (Danone Fund for Nature, 2010). Therefore, restoring and conserving

wetland habitats will increase the sequestration potential of our California landscape and reduce future GHG emissions.

WETLAND TYPES AND PRIORITIZATION

California is home to approximately half a million acres of wetlands (see Figure 1 below). Within the state there are many different types of wetlands (e.g. freshwater wetlands, salt marshes, freshwater forested and scrub wetlands, etc.), however not all wetlands are created equal in terms of carbon sequestration potential. To prioritize wetlands for possible acquisition or restoration efforts, a number of different factors must be considered. Assessing these factors for the various wetland types will allow us to identify wetland areas with the highest opportunity for climate change mitigation.

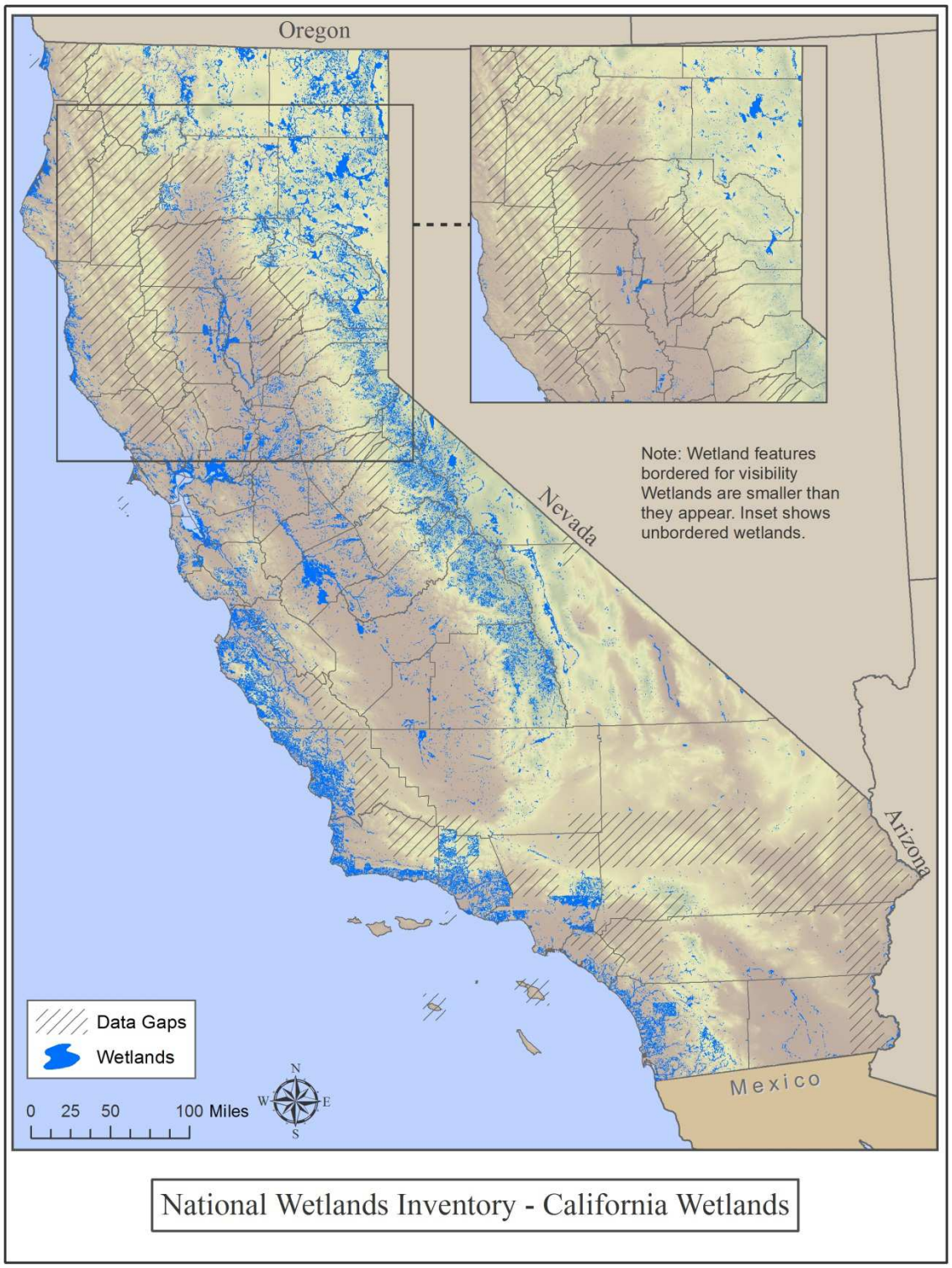

Figure 1: Wetlands in California based on the National Wetlands Inventory.

Important prioritization criteria may include factors such as sequestration rate and stability of sequestration, GHG storage capacity, longevity of sequestration potential, GHG emissions from the wetland, potential release of stored GHGs through degradation or conversion, and other important co-benefits for climate change adaptation and overall ecosystem health and function.

Generally, tidal wetlands, including both freshwater and saline wetlands, are thought to have substantial potential for carbon sequestration now and into the future (Crooks et al., 2009). Freshwater mineral-soil wetlands in the conterminous U.S. were found to have a net carbon balance of approximately 9.8 Mt C per year, with carbon sequestration outweighing carbon loss due to drainage of wetlands (U.S. Climate Change Science Program, 2008). Freshwater tidal wetlands in particular have among the highest sequestration rates of all wetland types including brackish tidal wetlands and salt marshes (Crooks et al., 2009) (see Figure 2). However, freshwater wetlands also emit greenhouse gases such as methane that can potentially offset the sequestration benefits associated with this wetland type.

Comparatively, salt marshes also have high sequestration rates but without the high level of methane emissions; methane emissions are found to generally decrease along a wetland salinity gradient (Poffenbarger et al., 2011). Carbon sequestration in salt marshes may therefore have a greater impact in reducing atmospheric GHG concentrations. However, salt marshes may provide less stability as long-term sequestration investments compared to freshwater tidal wetlands; freshwater wetlands accumulate soil at a faster rate and are therefore more likely to keep pace with sea level rise (Crooks et al., 2009). If a salt marsh cannot rebuild faster than the relative sea level rise in a specific location, the salt marsh may drown thereby deteriorating or eliminating its ability to sequester carbon; stored carbon however, would not be released once submerged.

Given the complexity of wetland carbon and methane fluxes and storage capacities, local knowledge of the wetland type and characteristics (such as vegetation, depth of wetland soils, size, etc.) will be an important input to the prioritization exercise. For example, carbon capture projects carried out by the California Department of Water Resources demonstrate how local factors can influence sequestration at a given location. Twitchell Island, a permanently flooded, managed wetland, is comprised of carbon-rich peat soils commonly found in the Delta. Tule and rice growth on Twitchell Island has not only stopped the peat soils from subsiding, but reversed subsidence by increasing root structure (accretion) which eventually yields soil production. Subsidence reversal in the project area has protected the large carbon stores in the soil that would be otherwise lost through subsidence, while also sequestering additional carbon from plant decay. Although some methane is emitted in the process, these conditions have created a net carbon sink in the project area, with a positive GHG flux of approximately 2.3 tons/acre CO2-eq as measured from May 2012 through April 2013.

Other information, such as the decision-support tool in Figure 3, may also be used to inform the prioritization process. This particular tool examines such factors as carbon

storage per unit area, sequestration rates, and GHG emissions (e.g. methane and nitrous oxide) in order to compare carbon offset potential of different wetland habitats. For example, using the tool to examine the prioritization criteria suggests that forested riparian areas also have generally high carbon storage and sequestration rates and low to medium emissions, which might make that community a viable option for restoration as well. Other useful information sources include comprehensive reports such as "Greenhouse Gas Mitigation Typology Issues Paper: Tidal Wetlands Restoration" (Crooks et. al, 2009), where sequestration rates are identified for multiple wetland types (Figure 2). Additionally, scientific articles and research on specific types of wetlands will provide valuable information to the process. Multiple resources will likely be needed to assess not only the sequestration potential of the wetland, but the feasibility of restoration and available management options to implement the desired actions.

Wetland Type	**Carbon Sequestration Potential ($gC\ m^{-2}\ yr^{-1}$, $gCO_2e\ m^{-2}\ yr^{-1}$)**	**Methane Production Potential ($gCH_4\ m^{-2}\ yr^{-1}$, $gCO_2e\ m^{-2}\ yr^{-1}$)**	**Net Balance**
Mudflat (saline)	Low (<50, 184)	Low (<2, 50)	Low C sequestration
Salt Marsh	High (50-250, 184-917)	Low (<2, 50)	High C sequestration
Mangrove	High (50-250, 184-917)	Low – High	Depends on salinity
Brackish Tidal Marsh	High (250-450, 183.3-1650)	High (5-100, 125-2,500)	Unclear[48]
Freshwater Tidal Marsh	Very High (500-1000, 1,833-3700)	High - Very High (40-100+, 1,000-2,500+)	Unclear – potential very high C[49]
Estuarine Forest	High (100-250, 366.7-	Low (<10, 250)	High C sequestration

Figure 2: Summary of carbon sequestration and methane production across the salinity interface (from Crooks et al., 2009). Note: 1gC ≡ 3.67 gCO_2e; 1gCH_4 ≡ 25 gCO_2e

		Carbon storage / unit area	Global total carbon storage	Sequestration rates	Carbon fluxes/area (3=high)	$N2_0/CH_4$ emissions (3=high)	Net CO_2 equivalent seq. (3 = net cooling)
Riverine	River, waterfalls, wadi	0	0	0	3	0	0
	Forested riparian /alluvial	2-3	2	? - 3	3	1-2	1-2
	Non-forested marshes / deltas	1-2	1	?	2-3	3	1
	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	1-2	1	1-2	1	3	1

Mineral soil flats &	Seasonal wet non-forested: meadows, salt pans, dambos	1	1	1	1	0-1	0-1
	Seasonal wet forested: swamps	2-3	2	1	2-3	0-1	0-1
Organic soil flats	Temperate, alpine and boreal forested wetlands	3	3+	0-2	1-2	1-3	1-2
	Temperate, alpine and boreal non-forested wetlands	3	3+	0-2	1-2	1-3	1-2
	Tropical non-forested peatland	3	1	0-3	2	2-3	1
	Rice paddies	2-3	2	0-1	?-2	1-3	1
	Tundra	2	2-3	0-1	1	1	0-1
	Tropical peat swamp forests	3+	1	0-3	2	1	2-3
Slope	Mineral soil: freshwater springs, fens, oases	1-2	1	0-1	2	1-3	1
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	3	1	0-3	2-3	1-3	1-2
Lacustrine	Natural: lakes, glacial lakes	1-2	1-2	1-2	1-2	1-2	?
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	1-2	1-2	1-3	2-3	1-3	1
	Marsh wetlands	1-2	1	2-3	2	3	1
Estuarine &coastal fringe	Salt marsh	2-3	1	3+	3	1	3
	Saline / coastal lagoons	1-2	1	2	3	1	2
	Mangroves	2-3	1-2	3+	3	1	3
	Nearshore: seagrass, kelp, macro-algal complexes	1-2	1	?-2	3	1	?-2
	Coral reefs	2	1	0-1	3	0	1-2
	Shellfish reefs	2	1	0-1	3	0	1-2
	Mudflats, tidal flats, beaches	1-2	1-2	0-2	3	1	0-2
	Coastal aquaculture / mariculture	1	1	?	?-2	?	?
Other	Caves	0	0	0	?	0	0
	Treatment wetlands	1	0	0	3+	3	1

Figure 3: Carbon storage and sequestration potential (naturally functioning wetlands, including artificial wetlands). From "Achieving Carbon Offsets through Mangroves and Other Wetlands" (Danone Fund for Nature, 2010)

CLIMATE CHANGE ADAPTATION CO-BENEFITS

In addition to sequestration rates and capacity, adaptation co-benefits should be part of the prioritization process. Generally, wetland restoration and conservation to promote carbon sequestration also provide an opportunity to meet some of the climate change adaptation objectives identified for natural resources in the state. For example, preserving these ecological communities with an eye towards increasing connectivity can help to create a large-scale, well connected, sustainable system of conservation areas that will be necessary for allowing species movement and persistence into the future. Sequestration activities will also restore and enhance ecosystem function to

conserve both species and habitats in a changing climate, and provide an opportunity to manage endemic and priority species populations. These are all important adaptation actions identified in the 2009 California Climate Adaptation Strategy (CAS 2009) for the biodiversity and habitats sector. Other co-benefits, the extent of which will vary by wetland type, include reducing land subsidence, providing habitat for fish and wildlife, and supporting esthetic, recreational and commercial uses. Certain co-benefits are also linked to other sectors. For example, wetland restoration and avoided degradation can reduce fire potential, serve as a buffer to flooding events by increasing flood capacity, restore ground water recharge and reduce the need for pumping, protect water quality and provide water supply reliability, etc.

Restoration can be considered a nature-based solution for addressing climate change by increasing sequestration and preventing future emissions while also protecting ecosystem services, which can have additional cost-benefits for the community. For example, projected sea-level rise is estimated to put approximately $100 billion worth of assets at risk in California, about two-thirds of which are concentrated in the San Francisco Bay Area (Heberger et al., 2011). Restoring San Francisco Bay's tidal marshes is one way to protect valuable shoreline development from sea level rise. "Tidal marshes can provide significant flood protection benefits by attenuating wave energy during storms, and at significantly lower cost than traditional flood risk management structures. By using tidal marshes in combination with earthen levees, construction and maintenance costs can be reduced by almost 50%" (ESA PWA, 2013).

ACTIONS

Actions can be taken now to undertake efforts to reduce future GHG emissions through wetland restoration. The following actions have been identified as important to effectively manage wetlands for sequestration in the future:

- Develop funding mechanisms to support efforts to restore, conserve, and protect wetlands.
- Restore, conserve, and maintain existing wetlands in addition to creating new areas that were not previously sequestering carbon.
- Avoid wetland degradation and conversion that could potentially reduce sequestration benefit and increase emissions
- Develop actionable policies and measures that conserve wetland resources that provide high sequestration benefit
- Pursue research related to measuring carbon sequestration potential that will inform and support management actions that maximize sequestration longevity

There are some challenges and issues we can expect to face when pursuing these actions. Cost of restoration activities, development in high priority wetland areas (especially in coastal locations), and jurisdiction over lands will impact the location and scale of restoration efforts. Once an area has been identified, there are other challenges related to GHG measurement and monitoring that will affect our ability to take these actions. For example, varying methodologies for GHG quantification and the need for vigilant monitoring could be seen as barriers. There is also scientific

uncertainty surrounding "wetland gas exchange rates (including CO2, CH4, and N2O), wetland interactions with the surrounding landscape (specifically carbon budgets), and carbon accumulation rates in the soil and litter column of wetlands" (Crooks et al., 2009). GHG accounting is also inherently difficult within a defined boundary when working with dynamic systems such as tidal wetlands. A comprehensive discussion of potential challenges and possible solutions can be found in the 2009 PWA report (Crooks et al., 2009).

ENABLING PROGRAMS

Many existing programs will support the implementation of the actions described above. A sampling of enabling programs and how they may aid in implementation are presented in Table 1 and described below.

California Department of Fish and Wildlife	
	Climate Science Program
	Resource Assessment Program
	Fisheries Restoration Grant Program
	Natural Community Conservation Planning Program
	Inland wetlands conservation program
	Riparian habitat conservation program
	Conservation Reserve Program
	Environmental Quality Incentives Program
	Wildlife Habitat Incentives Program
	Comprehensive Wetland Habitat Program
	California Waterfowl Habitat Program
	California Landowner Incentive Program
California Department of Water Resources	
	West Delta Program
	Central Valley Flood System Conservation Strategy

Table 1: Programs within the California Department of Fish & Wildlife and the California Department of Water Resources that will enable the identification of priority wetland areas for sequestration and help facilitate acquisition and restoration efforts.

Climate Science Program: The Climate Science Program at the Department facilitates the integration of climate change into all policies and programs at the Department as appropriate to lead to climate adaptation and mitigation actions on the ground. The program also coordinates with partners at a national, regional, and state-wide level on climate change research, projects, guidance, strategies, and more.

Natural Community Conservation Planning Program: Conservation planning tools, such as landscape-scale Natural Community Conservation Plans (NCCP), provide a regulatory framework for conserving biologically important landscapes. Many of these NCCPs already exist and many more are in development throughout California (e.g. the Bay-Delta Conservation Plan). There is tremendous potential through future land

acquisitions and habitat restoration in both existing and future NCCP plans to sequester even more carbon, benefitting the conservation plans and meeting the state's mandated reductions under AB 32.

Resource Assessment Program: One of the Department's most valuable assets is the wealth of scientific data collected under the Resource Assessment Program, including information on the distribution and abundance of fish, wildlife, native plant species, and the natural communities and habitats in which they live. The Department's Resource Assessment Program is well positioned to develop and implement a long-term and strategic inventory and monitoring program that could inform implementation and evaluation of projects that support AB 32 emissions reduction targets. Already the Department is working with other state, federal, and conservation partners to develop a statewide, long-term monitoring effort to evaluate the effects of climate change on indicator species, populations, communities and ecosystems. Currently, almost all data collection and monitoring is done in conjunction with partners in the UC and CSU system. Many studies to gather baseline data also include information from industry representatives and contributions from citizen scientists. Variables related to the distribution and abundance of priority species, habitats, and natural communities in California provide insight into ecosystem health and function, which could have direct ties to the ecosystem's ability to sequester carbon. Measuring these indicators could also contribute to a cost/benefit analysis of mitigation and adaptation projects to inform state actions to reach emissions reduction goals. In addition to species and habitat data, the RAP could begin to develop GHG emissions and storage data. Effectively monitoring species, habitat, and GHG data will be crucial to establishing a baseline from which to measure change and assess the efficacy of our efforts to reduce GHG emissions.

Fish Restoration Grant Program: The Fisheries Restoration Grant Program (FRGP) was established in 1981 in response to rapidly declining populations of wild salmon and steelhead trout and deteriorating fish habitat in California. This competitive grant program has invested millions of dollars to support projects from sediment reduction to watershed education throughout coastal California. Contributing partners include federal and local governments, tribes, water districts, fisheries organizations, watershed restoration groups, the California Conservation Corps, AmeriCorps, and private landowners.

Wildlife Conservation Board Programs: The primary responsibilities of WCB is to select, authorize and allocate funds for the purchase of land and waters suitable for recreation purposes and the preservation, protection and restoration of wildlife habitat. WCB approves and funds projects that set aside lands within the State for such purposes, through acquisition or other means, to meet these objectives. WCB's three main functions are land acquisition, habitat restoration and development of wildlife oriented public access facilities, which are carried out through its programs.

Wildlife Branch Programs: The Comprehensive Wetland Habitat Program (CWHP) was established in 1990 in response to the nationwide groundswell of interest in wetland

preservation, restoration, and enhancement. The CWHP provides coordination, direction, and funding for many of the Department's wetland habitat programs and activities. Although the responsibilities of the CWHP extend statewide, the program is focused primarily on the Central Valley.

DWR West Delta Program: The objective of the West Delta Program is to implement different land-use management strategies to reverse subsidence, while maintaining economic viability on Sherman and Twitchell islands and decreasing the stresses on the levee systems. These management strategies often also provide diverse habitat for wildlife and waterfowl. The Department is also conducting work to benefit species of wildlife that occupy wetland, upland, and riparian habitats and to provide recreational opportunities for hunting and viewing. In addition, property acquired and habitat developed through the Department's efforts will be available as mitigation for impacts associated with ongoing Delta flood management programs.

Central Valley Flood System Conservation Strategy (CVFSCS): The CVFSCS, an integral part of the Central Valley Flood Protection Plan, outlines processes to increase and improve the quantity, diversity, quality, and connectivity of riverine habitats in the flood management system. Ultimately the lands converted to wetland, riparian, and upland habitats will increase the opportunities for sequestering carbon within the flood system.

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Appendix D

This appendix was provided by the California Air Pollution Control Officers Association (CAPCOA). It contains a discussion of CAPCOA's and other local and regional efforts to implement climate protection strategies (Appendix D1) and examples of local GHG emission reduction strategies (Appendix D2).

Appendix D1

California Air Pollution Control Officers Association's and Other Local and Regional Efforts to Implement Climate Protection Strategies

Federal inaction on meaningful climate policy has made leadership at the state, regional and local levels critical to reducing greenhouse gas (GHG) emissions. Local governments across the country, and particularly in California, have stepped up to the challenge and have been implementing climate protection strategies for years. In the Bay Area alone, more than fifty local governments have developed and are implementing local climate action plans. From land-use planning, building codes, and zoning ordinances, to funding and operating regional transit systems, to air quality regulation, regional and local governments and agencies have considerable control and influence over GHG emissions.

As we shift focus to reducing GHG emissions 80 percent below 1990 levels by 2050, it is clear that state actions alone won't be sufficient. State policy is most effective with the support, engagement, and complementary actions of regional and local efforts. Regional and local governments and agencies can help ensure the climate protection strategies we pursue maximize co-benefits in financial savings, economic growth, air quality and public health, climate resilience, and quality of life in our communities.

ARB's approach to climate protection provides a number of opportunities for action at the regional and local levels. Key among these is addressing vehicle miles traveled (VMT). ARB has effective regulations to increase vehicle fuel efficiency and lower the carbon intensity of fuel, but VMT continues to increase, undoing some of the gains. Regional and local governments and agencies influence VMT-related GHG emissions through land use planning, both on a project-level basis and in integrated, long-term blueprints such as the Sustainable Communities Strategies developed. In addition, local land use decisions can promote climate-friendly policies such as transit-oriented and mixed-use development.

The existing building stock presents another prime opportunity for local action. Nearly 70 percent of all single family homes in California were built prior to the adoption of Title 24 (Building Energy Efficiency Standards). As most of these buildings will still be standing in 2050, this represents a sizable opportunity to reduce GHG emissions by reducing building energy use. Local governments can adopt energy efficiency standards for existing buildings that exceed Title 24, and in fact many already have. In addition, some local governments have adopted time-of-sale ordinances requiring energy efficiency upgrades exceeding Title 24 upon a change of title. These are the types of aggressive policies that must be put in place if the state is to meet the 2050 goal.

Local air districts have a key role to play reducing regional and local sources of GHG emissions. Because many actions to reduce air pollutants also reduce GHG emissions, many districts are actively integrating climate protection into air quality programs. Local

air districts also support local government climate protection programs, by providing technical assistance and data, quantification tools, and even funding. In addition, air districts can be key players in regional cross-media collaborations to mitigate and adapt to climate change.

As the State shifts its climate-protection focus to the long-term, regional and local governments and agencies will play an increasingly important role in achieving California's goals. In implementing local climate protection strategies, they can ensure that the pathway to achieve our 2050 goal brings the most benefit to our households and businesses, builds resilience against climate change, and helps our communities thrive.

California Air Pollution Control Officers Association (CAPCOA) Efforts

CAPCOA Greenhouse Gas Reduction Exchange (GHG Rx): CAPCOA identified a need among local governments and agencies for high-quality California-created GHG credits that can be used locally, such as to mitigate new land-use, transportation, or industrial and commercial projects, meet climate action plans, comply with regulations, or for voluntary purposes. In response, CAPCOA developed a GHG emissions credit exchange to provide an accessible, low-cost source of *real, permanent, quantified, validated, enforceable,* and *additional* credits.

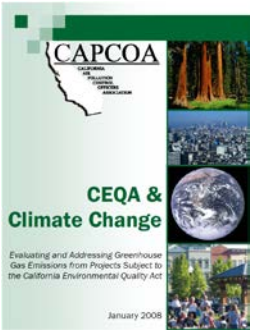
The CAPCOA GHG Reduction Exchange (GHG Rx) is an online service operated by CAPCOA and participating air districts. Its goal is to provide a secure, low-cost, high quality GHG exchange for credits created in California. Financial resources invested in-state will help create local jobs and realize needed air pollution co-benefits from projects in California.

In order to be eligible for listing on the GHG Rx, credits must be the result of projects that have occurred within California, and must meet specific quality criteria. Credit projects are evaluated by qualified staff at participating air districts to ensure the projects meet the quality criteria established by CAPCOA that ensure the credits are *real*, *permanent*, *quantified*, *validated*, *enforceable*, and *additional*. These criteria are embodied in a Credit Quality Criteria document, and specific protocols approved by CAPCOA. The GHG Rx criteria require the reviewing district to conduct an initial physical review of the project, as well as periodic site visits going forward. Credits are issued with a legally binding instrument that specifies the terms of approval and requires the holder to notify the district of any changes in the status of the credits. Additional information about the CAPCOA GHG Rx is available at: http://www.ghgrx.org/.

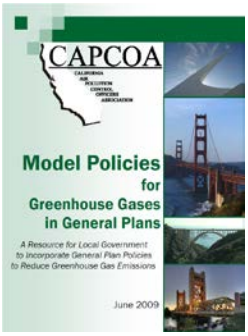
Resources: CAPCOA has taken a leadership role in creating a series of GHG resources for local governments addressing climate change. These resources include: *CEQA and Climate Change*; *Model Policies for Greenhouse Gases in General Plans*; and *Quantifying Greenhouse Gas Mitigation Measures*. The quantification methodologies were incorporated into an online project evaluation tool, the California

Emissions Estimator Model, or CalEEMod, which is now widely used throughout the State.

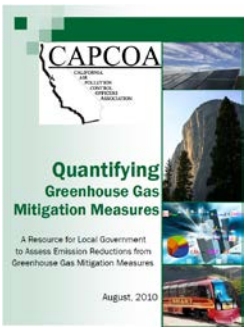
- ***CEQA and Climate Change -*** *Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act* ***(CAPCOA, 2008):*** Air districts have traditionally provided guidance to local lead agencies on evaluating and addressing air pollution impacts from projects subject to CEQA. To provide a common platform of information and tools for decision makers, CAPCOA prepared a resource document reviewing policy choices, analytical tools, and mitigation strategies. The paper provides alternatives and analyses for public agencies establishing procedures for reviewing GHG emissions from projects under CEQA. It offers three alternative programmatic approaches toward determining whether GHG emissions are significant. The paper also evaluates tools and methodologies for estimating impacts, and summarizes mitigation measures. It is available at no cost at: http://www.capcoa.org/documents.



- ***Model Policies for Greenhouse Gases in General Plans -*** *A Resource for Local Government to Incorporate General Plan Policies to Reduce Emissions of Greenhouse Gases* ***(CAPCOA, 2009):*** CAPCOA prepared the Model Policies Report in response to requests from local governments for information and resources to address GHG emissions in planning documents. The Model Policies Report provides a toolbox of policies, strategies and model language that can be used in General Plans, Climate Action Plans, and other planning efforts. It addresses the effectiveness of different goals, objectives, policies and implementation measures to reduce GHG emissions. The Report provides model language for GHG policies in General Plan elements, including a menu of approaches that are currently in use. It is offers flexible guidance to allow for different approaches to address GHGs in General Plans, and is available at no cost at: http://www.capcoa.org/documents.



- ***Quantifying Greenhouse Gas Mitigation Measures -*** *A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures* ***(CAPCOA, 2010):*** This report quantifies mitigation of greenhouse gas emissions associated with land use, transportation, energy use, and other related project areas. The mitigation measures quantified in the Report generally correspond to measures discussed in CAPCOA's earlier reports: *CEQA and Climate Change*; and *Model Policies for Greenhouse Gases in General Plans*. The measures are presented in Fact Sheets. The Report includes a step-by-step guide to using a Fact Sheet to quantify a project, including the project-specific data the user needs to provide. The Report also outlines procedures and limitations for quantifying projects where measures are combined; the limitations



ensure emission reductions are appropriately quantified and are not double counted. As a general guide, tables present approximate ranges of effectiveness for each of the measures. The report is available at no cost at: http://www.capcoa.org/documents.

- ***California Emissions Estimator Model (CalEEMod, 2011):*** The California Emissions Estimator Model (CalEEMod), developed in cooperation with air districts throughout the State, is a new statewide land use project emissions model designed as a uniform platform to quantify potential criteria pollutant and GHG emissions associated with construction and operation from a variety of land uses, such as residential and commercial facilities. CalEEMod calculates indirect GHG emissions from energy use, water/wastewater conveyance, solid waste disposal, and vegetation planting and/or removal and the benefits from implementing mitigation measures, including GHG mitigation measures developed and approved by CAPCOA. The model analyzes at the air district, county, air basin, or State level using approved emission factors, established methodologies, and the latest survey data. The model is available free of charge and can be downloaded and operated from one's own computer. The latest version of the model (CalEEMod 2013.2), a User's Guide, User's Tips, Frequently Asked Questions, and future events, such as upcoming training sessions, can be found on the CalEEMod website, www.caleemod.com.
- ***Model Rule to Implement Federal GHG Permitting Requirements:*** On May 13, 2010, the EPA issued a final rule addressing GHG emissions from stationary sources under Clean Air Act (CAA) permitting programs. The rule sets thresholds for GHG emissions that define when permits are required under the Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs for new, modified, and existing industrial facilities. Local districts were required to develop local programs to implement these new federal requirements that became effective on January 1, 2011. CAPCOA coordinated the development of a model rule that districts could use to implement these new requirements. The Association also provided model letters for districts to meet federal notification, status update, and submittal requirements.

Conferences

- ***The Future Is Green Conference & Expo:*** The Future is Green Conference & Expo, held in September 2008 in Long Beach, attracted more than 2,700 individuals over the three-day event. This included more than 1,000 attendees during the expert panels and keynotes; nearly 100 teachers for the teachers' workshop and nearly 100 entrepreneurs for the green technology business workshop; and over 1,300 middle and high school students for the student field trip days. Additional information about the event, as well as presentations and materials can be downloaded at no charge at: www.capcoagreen.com.
- ***The CAPCOA Climate Change Forum: The Harmonization of California and Federal Climate Change Programs:*** The CAPCOA Climate Change Forum was held in August 2010 in San Francisco. The purpose of the two-day event

was to promote consistency and collaboration on policy decisions at the state and federal levels in order to create a foundation for sustainable environmental and economic development, focusing on how recent federal climate change legislation and EPA activities will impact the implementation of AB32. The event consisted of two days of compelling speakers, collaborative discussions, networking and a tradeshow.

Looking Ahead at CAPCOA Efforts - *CAPCOA has identified several areas where GHG reduction credit protocols would be useful, and individual districts have volunteered to take the lead coordinating these efforts, working with ARB and interested stakeholders. The Association will also prepare an update and expansion of its Quantification Report, to include new measures and update baseline assumptions for various sectors, including transportation and energy. These updates will be incorporated into CalEEMod. CAPCOA is also working with ARB to reestablish a periodic symposium on air quality issues for local elected officials, expanded to include climate strategies and the synergies between the two, with a focus on economic benefits.*

Local and Regional Efforts

The following are examples of actions being taken by visionary and dedicated local governments in California, from the North to the South, the Coast, inland valleys, and mountains. More complete descriptions of these projects and others can be found in Appendix D2.

Stationary Sources- All air districts have programs in place to incorporate GHG related requirements into operating permits of major stationary sources subject to Title V of the federal Clean Air Act. These permits must include all applicable requirements for the permitted facility. In addition, districts with delegated authority or implementing rules in the State Implementation Plan also have preconstruction review programs for major sources, or major modifications to sources of GHG emissions. These programs require best available control technology, and in many cases, an energy efficiency plan.

A number of local districts also have category-specific rules that limit emissions of GHGs. Some of these, such as landfill regulations and refrigerant management, provided the initial platform for the statewide regulations adopted by the ARB. The South Coast AQMD has three regulations to reduce refrigerant emissions from stationary air conditioning and refrigeration systems and motor vehicle servicing, as well as restrictions on CFCs and halons from sterilization, fumigation, and fire extinguishing equipment. The Bay Area AQMD has implemented fees on GHG emissions, which fund its climate protection programs and provide incentive to regulated facilities to reduce emissions. Many districts also have programs and rules to reduce wood smoke, including black carbon and other aerosols. For example, the San Joaquin Valley APCD program includes mandatory no-burn days coupled with a robust incentive program that has replaced 3,267 wood-burning units with gas-fired units. The Sacramento Metropolitan AQMD Residential Wood Combustion Changeout program removed 2,866

units or replaced them with gaseous/electric units between 2006 and 2009. About 82% of fireplaces were replaced with gaseous units and 49% of woodstoves/inserts were replaced with gaseous units.

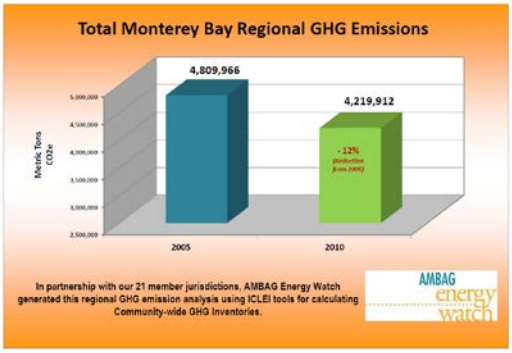
Black Carbon Reductions from Woodsmoke:

Sacramento Metropolitan AQMD regulations on residential wood combustion will reduce up to 52,000 tons per year of CO2e by 2030.

Looking Ahead at Stationary Sources- Local districts could prepare best practices guidance for energy efficiency for specific source categories, and perhaps offer streamlined permitting for sources that opt to follow those practices. The Districts and ARB could also partner to identify stationary source reduction strategies, and determine collaboratively whether those strategies would be most efficiently and effectively implemented through statewide regulation, local regulation, or on a case by case basis through permits. In addition permit review and compliance activities can encompass GHG requirements.

Inventory Programs- Air districts and local governments – often working together – have put considerable resources into developing baseline and business-as-usual inventories to support GHG planning and reduction efforts. On the central coast, for example, the SLO County APCD Board allocated, in 2008, a total of $103,578 from mitigation funds to develop GHG emission inventories of municipal operations and communitywide sources for all seven incorporated cities in SLO County and a comprehensive countywide report on GHG emissions.

The Association of Monterey Bay Area Governments (AMBAG) and Pacific Gas and Electric Company (PG&E) partnered to deliver the AMBAG Energy Watch Program, a regional leader in energy efficiency in Monterey, San Benito and Santa Cruz counties. AMBAG Energy Watch developed GHG inventories for the Monterey Bay region's 21 jurisdictions including: 2005 Baseline GHG Inventories for municipal operations and community-wide emissions; 2009 and 2010 GHG Inventories; and periodic updates for all 21 AMBAG member jurisdictions.



In the San Joaquin Valley, the district prepared county-wide GHG emissions inventories for Kern and Kings counties to assist those counties in prepare their upcoming Climate Change Action Plans. And in Southern California, the South Coast AQMD, with help from an EPA grant, modified its AER emissions reporting system to support consolidated GHG emissions reporting to federal, state, and local regulators. The modified system supports consistency in information across reporting platforms.

Looking Ahead at Inventory Programs – Districts and ARB should collaborate on specific pollutant and/or sector inventories, for example short-lived and higher GWP pollutants like methane. The agencies should also work with EPA to develop a

consolidated emissions reporting platform to enhance consistency and save resources for agencies and regulated sources. The platform can be designed to support continuing adaptive management of the Cap and Trade program for stationary source impacts, and to target community-based reduction strategies.

Emissions Banking and Trading Programs – Districts are developing GHG emissions banking and trading programs, or updating existing programs for traditional air pollutants to include GHGs. Some districts, such as the South Coast and Sacramento Metropolitan AQMDs have formal GHG Banking rules, while others, like Placer County and Northern Sonoma APCDs, use existing authority and contracts to approve and track GHG emission credits. All of these districts are participants in the CAPCOA GHG Rx.

Looking Ahead at Emissions Banking and Trading Programs – Local districts and ARB should work together to identify sectors where credit protocols could support cost-effective reductions to complement other program activities, and to demonstrate the feasibility of advanced technologies and innovative practices.

Grants & Incentives – Most air districts implement grant programs that reduce air pollution, including programs that reduce transportation related emissions through grants for clean passenger cars and trucks, lower emission school buses, and mitigation of goods movement, as well as agricultural assistance projects, and other engine categories. These air district grants also support enhanced transit operations, creative trip reduction strategies. Collectively, districts have awarded over a billion dollars in total grant funding. These funds reduce smog, toxic air pollutants, and GHGs.

San Joaquin Valley APCD
Ag Pump Electrification Program

- Partnership with the agricultural industry and the local electric utilities (PG&E/SCE).
- Replaced over 2,000 diesel agricultural irrigation pump engines with electric motors.
- Reduced more than 400,000 tons of CO2(e).

Many districts have also made grant funds available for energy related programs and specific GHG planning and reduction projects.

Bay Area AQMD Climate Protection Grant Program

- Funded 21 local climate action plans and climate elements in general plans, creating a surge of climate action planning in the Bay Area
- Reduced over 54,000 tons of GHGs
- Created over 100 permanent and temporary jobs for adults and youth
- Over 500 public meetings convened, serving over 25,000 participants

In 2007, the Bay Area Air Quality Management District implemented a Climate Protection Grant Program, awarding 53 Climate Protection Grants totaling $3 million to local governments and non-profit organizations in all nine counties of the Bay Area for (1) Youth; (2) Climate Protection Planning; (3) Capacity-building; (4) Regionalizing Best Practices; and (5) Fostering Innovation – incubating innovative new projects or policy approaches to reducing GHG.

The Santa Barbara County Air Pollution Control District, in partnership with the Santa Barbara County Education Office and local utility companies, has for the last four years offered small grants under the "Care for Our Earth" Teacher Grant Program. The program awards grants in the amount of $200 - $250 each to teachers for educational programs that aim to save energy, cut traffic and pollution, or save water. A higher grant tier covers more extensive projects. From 2010 to 2012, 63 grants were issued to 9 school districts. Additional information available at: http://www.sbcapcd.org/teachers.htm.

Care for Our Earth Teacher Grant Program - 2012

- At Pine Grove Elementary School in Orcutt, fifth graders formed a "Power Down Patrol" to inspect classrooms at breaks to be sure lights and equipment were turned off.
- Students at Carpinteria Family School learned how to ride their bicycles safely and legally in traffic.
- Students at Righetti High School in Santa Maria produced articles, songs and more about pollution & global warming.
- Seventh graders at Vista de Las Cruces School in Gaviota calculated energy use for computer equipment and designed a program to save energy.

Looking Ahead at Grants and Incentives – Funding for the Carl Moyer program, the Air Quality Improvement Program, and the Alternative and Renewable Fuel and Vehicle Technology Program, has been extended to 2023. Non-road sources will offer key reduction opportunities in the future. For example, the Santa Barbara District developed a Vessel Speed Reduction (VSR) incentive based on programs at the ports of Los Angeles and Long Beach. The district estimates a VSR program extending up the entire California coast could reduce emissions of GHG from ocean going vessels by 50 percent.

Robust and continuing funding is needed for reduction projects in the energy sector. Funds should continue to demonstrate innovative technologies/strategies, but specific funding should be set aside to the most successful and cost-effective projects. Air districts can assist the State in managing small scale grants, and grant programs designed to address specific community impacts, and environmental justice. For example, small grants could provide incentives to replace in-home combustion appliances like furnaces, water heaters, and woodstoves with cleaner technology. They could also replicate low-income focused weatherization programs like the one implemented in Sacramento.

Districts can target grants, incentive programs and demonstration programs to commercialize and implement technology transformations and create the needed infrastructure for new technologies. Incentive programs should also expand to include revolving loans, low-interest financing, and loan guarantee programs that stretch grant funds further.

Outreach and Education – Engaging local communities and schools is a key activity for air districts. This can take the form of newsletters, talks, information booths at fairs, contests, videos, schools programs, and many other strategies. Engaged and informed communities help local governments make better decisions, and are more prepared to invest their time and resources in a greener, more vital future.

Since 2006, the San Luis Obispo APCD's Annual Outreach Plan has focused efforts to reduce GHG emissions to meet the goals of AB 32. Key outreach programs include 1) Central Coast Clean Cities Coalition (C5) that promotes the use of alternative fuel vehicle technologies; 2) Food Miles Campaign to preserve local agricultural operations and reduce vehicle miles traveled transporting food; 3) SLO Car Free incentives program for visitors coming to the Central Coast; and 4) Energy Awareness program implemented in partnership with the County of San Luis Obispo to increase public awareness of the environmental and cost-saving benefits of reducing energy use and switching to renewable energy sources, including a countywide "Energy Event" to promote energy conservation and renewable energy.

San Luis Obispo APCD Outreach Results

- San Luis Obispo County has received an official "Clean Cities" designation as a result of the significant efforts of the C5 group to promote clean fuels use in our county.
- The SLO Car Free website received over 10,000 unique visitors in the past year alone, and over 2,000 people have registered to travel to SLO

Grants through non-profits leverage important community connections. In Forestville and Healdsburg, Northern Sonoma air district funding allowed the Climate Protection Campaign (CPC) to bring a complete education and emission reduction module to high school classrooms through the CoolSchools Program.

- The eCO2commute Student Trip Reduction Module at Healdsburg High School in 2009 taught students about the design, development, implementation, tracking and statistical analysis of a program to change student commute patterns.
- The Green Team Waste Reduction project at El Molino High School in 2010 taught students about development, implementation, tracking and analysis of a program to change student and faculty behavior surrounding waste, recycling, and composting.

Students learn in class then implement the programs and track results.

<u>Looking Ahead at Outreach and Education Programs</u> – Districts can support ARB with outreach efforts around specific Scoping Plan strategies. Local outreach efforts will continue to educate businesses and consumers about potential cost savings associated with energy efficiency, clean transportation, and other conservation strategies.

<u>Plans</u> – Air districts and ARB have begun integrated planning for air quality, climate protection and sustainable transportation. The South Coast District, Southern California Association of Governments, and ARB recently released "Powering the Future" as a long-term, coordinated vision to address these important goals. Other districts are addressing the same issues in different ways.

Local governments around the state are stepping up and adopting local GHG reduction targets, and plans to achieve those reductions. Local districts support these efforts with recommended policies, analysis, and funding. As a result, commitments are being made from rural California to its metropolitan centers. These commitments will shape transportation, land use, and energy policies at the local level for decades to come. They will create real and long-lasting emission reductions, air quality benefits, and vital, sustainable communities.

In December of 2012, the Butte County Association of Governments (BCAG) Board of Directors approved the area's first Sustainable Communities Strategy (SCS) as a component of the 2012 Metropolitan Transportation Plan (MTP). The 2012 MTP/SCS will reduce the Butte County region's per capita GHG emissions from passenger vehicles by 2% for the years 2020 and 2035, from 2005 levels, while managing an estimated increase of 110,000 persons, 47,000 new housing units, and 41,000 additional jobs. The City of Chico adopted their Climate Action Plan (CAP) in November 2012 with a goal to reduce greenhouse gas emissions (GHG) by 25% by 2020. The City General Plan policies incorporated into the plan reduce community-wide greenhouse gas emissions from the transportation, energy, and waste sectors. The City of Gonzales adopted a Climate Action Plan in February 2013. The plan is a product of the "Gonzales Grows Green" Sustainable Community Initiative, an outgrowth of the City's Vision Statement adopted in 2005. The plan provides energy use, transportation, land use, water use, and solid waste strategies to reduce Gonzales' greenhouse gas emissions levels to 15 percent below 2005 levels by 2020.

Local GHG Reduction Commitments

- City of Chico: 25% by 2020
- City of Gonzalez: 15% below 2005 levels by 2020
- City of Arcata: 20% below 2000 by 2020
- Sonoma County & All Nine Cities: 25% below 1990 levels by 2015

The goal of the Humbolt County has a living Climate Action Plan is to reach 1990 GHG levels by 2020, and the City of Arcata Community GHG Reduction Plan is designed to reduce GHG emissions to 20% below 2000 levels by 2020.

In 2005, the ten local governments within Sonoma County set a mutual GHG target (25 percent below 1990 levels by 2015). The Regional Climate Protection Authority (RCPA) was created by the Legislature in 2009 to coordinate their climate efforts; it is made up of representatives from each of the cities and the Board of Supervisors. RCPA is leading development of Climate Action 2020, a coordinated, comprehensive plan for each jurisdiction with specific measures to reduce GHGs from building energy use, transportation, water use and transport, waste, wastewater and agriculture.

Looking Ahead at Plans – Air quality and climate protection planning will need to become more fully integrated. In addition, energy and transportation planning will have to become more explicitly integrated with air quality and climate protection plans. Air districts can work with state agencies and local governments to identify and expand regional strategies that address air quality, climate, energy, transportation, and land use. They will also continue to support local government climate planning.

CEQA – Air districts up and down the state provide technical support to local lead agencies reviewing projects under CEQA. Districts also comment on air quality and GHG analyses in CEQA documents as Responsible Agencies, and occasionally serve as Lead Agencies for certain project types. A number of districts, including San Joaquin Valley and the South Coast, have adopted formal thresholds for review of GHG emissions under CEQA. The Bay Area undertook an extensive threshold adoption process. In March 2012, the SLO County APCD Board adopted GHG CEQA Thresholds of Significance for residential, commercial and industrial projects, to assist lead agencies evaluating GHG emission impacts from new land use projects subject to CEQA review. Significance thresholds streamline CEQA review, provide consistency and certainty, and encourage project proponents to minimize GHG emissions. Additionally, the San Joaquin Valley APCD has developed numerous Best Performance Standards for stationary sources and development projects that identify mechanisms for projects to reduce their GHG emissions to levels such that their GHG emissions are not significant for purposes of CEQA review.

Looking Ahead at CEQA – The Legislature may address CEQA streamlining concerns. If this includes incentives for projects to minimize and mitigate GHG emissions, it could help achieve climate and air quality goals. More jurisdictions will establish GHG thresholds going forward, or will adopt comprehensive CAPs that allow simplified approval of projects that are consistent with measures in the CAP. Air districts will continue to provide technical support for these efforts.

Energy

Building Energy Efficiency – Existing building stock presents a significant opportunity to reduce energy use and associated GHGs. Efficiency projects also save money. Low-income households spend an average of 14% of their income on energy, compared to 3.5% for most other households. The SMAQMD collaborated with Sacramento Association of REALTORS®, Rebuilding Together Sacramento, Sacramento Habitat for Humanity, and the University of California Davis School of Civil and Environmental Engineering to weatherize housing for low-income residents in the Sacramento Region. Using both paid and volunteer workers, the Home Energy Conservation program installs compact florescent lights, weather stripping, window caulking, outlet sealers, water heater blankets, water heater pipe insulation, and low-flow showerheads. These weatherization components deliver the greatest GHG emissions reductions for the least cost. Residents also receive information on other energy saving strategies. The University of California, Davis, quantifies energy savings from the upgrades.

Sacramento Home Energy Conservation Program

- Since April 2012, over 100 low-income, single-family homes have been upgraded.
- Roughly 1 ton per year of GHG reduced per home.
- Total average cost of upgrades per home is $300.
- Recipients save up to $360 annually.

Around Monterey Bay, AMBAG recently launched a program to improve energy efficiency for local agricultural businesses, non-profits, school districts, special districts, municipal facilities, and hospitality facilities. As of September 2013, the combined direct installation program, including agriculture, installed equipment projected to generate energy savings of 1,116,393 kWh each year.

The San Joaquin Valley APCD promoted the Regional Energy Efficiency Strategy with partnerships with energy agencies, municipalities, utilities, and other stakeholders to inform and educate residents, businesses, and communities on energy efficiency opportunities. As a part of these partnerships, the San Joaquin Valley APCD administered an Energy Efficiency and Conservation Block Grant with 36 participating cities and counties reducing electricity consumption by 4.7 million kwh per year.

Further South, the emPowerSBC Program helps homeowners make energy saving improvements with incentives, financing, qualified contractors and expert advice. Eligible projects include air sealing, adding attic insulation, duct sealing, hot water pipe insulation and low-flow showerheads, additions of solar water heating, and electric system upgrades. Additional information at: http://www.empowersbc.org/home.

emPowerSBC Since 2012

- $1.7 million in retrofits in 217 homes
- One home cut energy use by 52%

Sonoma County Energy Watch (SCEW) is a partnership between the County of Sonoma and PG&E, which was established in 2009. It provides free energy audits, efficiency consulting, incentives and rebates, and financial consultation to local governments, nonprofit organizations, small businesses and special.

SCEW Results Since 2009

- Over $1 million in incentives for over 170 individual projects
- Saved about 5.2 million kWh & 16,570 therms
- Reduced 1,265 metric tons of CO2e
- Created an estimated 239 jobs.

The Sonoma County Comprehensive Energy Program was completed by County General Services in 2010. It included 39 efficiency and alternative energy measures at 24 County buildings, based on a comprehensive inventory of facility energy use. Measures included: installation of a 1.4 MW Fuel Cell Cogeneration Power Plant; lighting retrofits at 20 buildings; HVAC replacements or rebuilds in 4 buildings; upgrades of HVAC motors and variable frequency drives; water efficiency retrofits at 16 buildings; and a central mechanical plant upgrade. Projects performance is tracked and quantified. Information at: www.sonoma-county.org/gs/energy/pdf/CEP_Fact_Sheet.pdf.

Sonoma County CEP: At a Glance	
Project Cost	$22,272,029
Incentives, Grants, and Rebates	$3,941,226
Financed Amount (over 16 years)	$18,730,803
Interest Rate	4.98%
Annual Energy Cost Escalation	5%
Total payments	$31,794,615
Water saved = 16,500,000 gallons	$247,300
Electricity saved = 2,262,445 kWh	$319,839
Natural gas saved = 171,164 therms	$121,500
Fuel cell generation = 10,830,193 kWh	$1,118,800
Total Cost Savings	$1,807,439
First year of positive cash flow	Year 12
Cumulative positive cash flow at 25 yrs	**$38,404,231**

Even small, rural communities have found ways to invest in efficiency projects. The McKinleyville Community Services District retrofitted streetlights in one section of the city with LEDs during the first phase of a streetlight replacement program. In the second phase, funded with a zero percent interest loan from PG&E, they will replace all remaining fixtures. The loan payback is less than ten years, with cost savings continuing into the future.

A financing approach for efficiency projects is "Pay-As-You-Save" on-bill financing, also known as PAYS. These programs allow utility customers to make energy and water efficiency upgrades with a loan that is repayed through the utility bill. The City of Windsor demonstrated a PAYS pilot program called Windsor Efficiency PAYS® (Pay As You Save), with support from the Regional Climate Protection Agency. PAYS has served approximately 5% of all residential units in Windsor, and achieved average savings of: 10% of energy use; 20% of indoor water use; and, $15 per month in net utility costs. Based on initial program successes, the RCPA is working to expand the program through the Bay Area Regional Energy Network (BayREN). The BayREN PAYS Pilot continues to work with Windsor, as well as with the City of Hayward, the San Francisco Public Utilities Commission, and the East Bay Municipal District.

Looking Ahead at Building Energy Efficiency – The Districts and ARB should identify successful projects with well-defined cost-savings and develop "toolkits" to streamline implementation. Agencies should provide creative, low-interest financing packages to allow jurisdictions to implement energy efficiency projects, and to offer them to residents and businesses. Funding for these efforts can come from Cap and Trade revenues, Public Benefits charges/programs, or surcharge mechanisms modeled after the successful Carl Moyer program. Expanded bonding authority could allow local jurisdictions to establish funding on their own. Forward capacity markets for energy efficiency, similar to the program operated by Vermont, could fund aggregated projects.

Alternative Energy – Creative financing and incentive funding for alternative energy projects are helping increase installation of these projects throughout the state. On the Central Coast, a non-profit, the Community Environmental Council (CEC) created the Solarize program, which leverages group purchasing and discounted pricing to help local homeowners install solar electric systems. CEC, in partnership with other organizations, has implemented Solarize programs in a number of Central Coast regions including Santa Barbara, Ojai Valley, San Luis Obispo, and Santa Ynez Valley. CEC evaluates and selects experienced solar installation companies, and negotiates a limited time, discounted price that is then offered to local residents who utilize the program.

Sonoma County Energy Independence Program (SCEIP) PACE Funding Summary since 2009 7,647 tons CO2e Reduced per year		
	Number	Associated Funding
Applications Received	2,746	$99.5 million
Applications Approved	2,118	$69.8 million
Projects Funded	1,963	$64.0 million
Projects with funding pending	37	$1.1 million

The City of Berkeley and the County of Sonoma both operate Property Assessed Conservation Easement (PACE) programs. PACE is a financing option that

authorizes a local government to provide up-front funding to eligible property owners to finance the installation of energy efficiency and water conservation improvements and renewable energy systems on their property. Funds are repaid to the city or county with interest, over time on the owner's property tax bill. The financing is 100% voluntary.

Community Choice Aggregation (CCA) is a system adopted into law in the states of Massachusetts, Ohio, California, New Jersey and Rhode Island which allows cities and counties to aggregate the buying power of individual customers within a defined jurisdiction in order to secure alternative energy supply contracts. Currently, nearly one million Americans receive service from CCAs. The California Legislature passed Assembly Bill 117 in 2002, enabling Community Choice Aggregation.

Marin County established its CCA, Marin Clean Energy, in May of 2010. It provides *light green* (50% renewable) and *deep green* (100% renewable) electricity purchase options. Deep green costs ratepayers selecting it $5 per month more than light green rates.

In Sonoma County, Sonoma Clean Power (SCP) is a non-profit agency independently run by the Sonoma County cities that have joined the program, and the County of Sonoma. It provides customers energy generated by renewable sources at competitive rates (residential rates are expected to be between 1.8% below and 1.1% above PG&E's rates; commercial rates are estimated between 3.1% below and 0.5% above PG&E). SCP will provide 33% renewable energy in early program years, increasing to 50%, and 100% renewable power for about $10-$15 extra per month for a typical single-family house. The cleaner power will reduce GHGs from electricity use by at least 3.1 million tons over 20 years.

The Monterey air district's APCO is the Vice Chair of the Board for the Monterey Bay Community Power Project, Project Development Advisory Committee. The project is investigating the option of community choice aggregation for the Monterey Bay region. The next step in the project is raising funds to conduct a technical feasibility study.

<u>Looking Ahead at Alternative Energy</u> – Expansion of alternative energy systems depends on funding and the ability to address key logistical challenges. Cap and Trade revenues, as well as creative funding strategies like those described for financing energy efficiency programs (above) would help address the funding shortfall. It could also provide start-up financing for PACE, CCA, and other similar programs. PACE, CCA, and power pooling authorities can all play an important part in increasing renewables. PACE programs would benefit from national legislation to address the impediments created by the rulings of the FHFA, as well as public-private partnerships in finance marketplace. In addition, expanded net metering would help defray costs of ownership, and decrease the pay-back time for renewable energy projects. Access to utility information hampers creation of these types of programs as do unresolved questions about access to / use of existing infrastructure owned by the utilities; reasonable, state-sanctioned mechanisms to resolve these questions could support expansion of PACE, CCA, and other similar programs.

Transportation

Alternative Fuel & Electric Vehicles – The Bay Area, Northern Sonoma, and South Coast air districts are all members of the California Plug-in Electric Vehicle Collaborative and have devoted significant resources to Collaborative work products as well as supporting electric vehicles in their own regions. As a result, communities around the San Francisco Bay, in Sonoma County, and in the greater metropolitan Los Angeles area are among the most "EV Ready" in the nation. However, across the State, air districts are working to make communities "EV Ready," with coordinated efforts among the San Luis Obispo, Santa Barbara, and Ventura air districts; leadership by the AMGAG and the Monterey Bay air district in San Benito, Santa Cruz, and Monterey Counties; and readiness projects from San Diego to Sacramento to Eureka. There are nearly a thousand charging stations in California.

EV Infrastructure

- Over 500 Level 2 stations and 20 DC Fast Chargers in the South Coast
- Over 180 public charging stations and 2700 home charging units in the SF Bay Area
- 60 active charging stations in the Sonoma County Electric Trail (116 total); over 20 MWh of cumulative charging, over 20 MT CO2e reduced.

The major metropolitan areas have significant investments in natural gas, and technology development programs for biofuels. The South Coast air district has partnered with other companies and agencies to develop and install hydrogen technologies and infrastructure, including: developing hydrogen storage capability for a gas bending facility at the University of California, Irvine; partnering with Hydrogenics Corporation to install a hydrogen generation and fueling station at SCAQMD Headquarters (using electrolysis of water to produce hydrogen, with backup electrical power production using a hydrogen-powered internal combustion engine); partnering with UCLA to demonstrate a new publicly available hydrogen refueling station open 24 hours a day 7 days a week; and other key projects.

Local governments have also stepped up with their own fleets. In Sonoma County, the Board directed County staff to reduce emissions from the County's On-Road fleet by 20% by 2010. Hybrid electric and all electric vehicles comprise 29% of the County's light equipment fleet. The Sonoma County Fleet was recently recognized as number 14 in 100 Best Fleets in North America (out of approximately 38,000 government fleets) by Government Fleet Magazine, INVERS, and Property Room.

Sonoma County Green Fleet Results

- Saved over 137,000 gallons of gasoline.
- Reduced 2,925 tons of GHG while fleet VMT increased by over 10,000,000 miles compared to the previous 10 year baseline.
- Electric hybrid fleet averages 47.5 mpg, compared to 20.4 mpg for conventional vehicles.

Looking Ahead at Alternative Transportation – For the next several years, electric and other alternative fueled vehicles will continue to need incentive funding. The districts and ARB should collaborate with other interested stakeholders to develop a multi-year strategy for targeting and adjusting funding levels based on market penetration and

consumer behavior. Similar collaboration should address more coordinated plans for charging infrastructure, designed to optimize the network of stations within a region and between regions, building from data available from stations already installed, vehicle use patterns, and other key information. Expanded access to volume purchasing and other similar creative funding can help reduce upfront costs.

Trip Reduction – Bay Area Bike Share Program is one of the first public bike share services offered in California and the first bike share program in the nation to launch as a regional, multi-city service. Program members can check out a bicycle from a network of automated stations, ride to another station nearest their destination, and leave the bicycle safely locked for someone else to use. Bicycles are available at stations for use in San Francisco, Redwood City, Palo Alto, Mountain View, and San Jose, near transit hubs, high-density residential areas and key destination points such as shopping or employment centers. Current prices are $88 per year for a full-time member or $22 for a three day pass and $9 per day for the casual rider. The Air District is the lead administrator.

The Santa Barbara Car Free project, founded and led since 1998 by the Santa Barbara County Air Pollution Control District is a collaborative effort to reduce air pollution and greenhouse gas emissions from tourists' cars. Amtrak® and more than 100 businesses, agencies, transportation providers, organizations, and local tourism businesses participate. The Project's 2013 "Cool Car Free Discounts" gives discounts from more than 66 hotels and activities and a 20% discount on the Amtrak Pacific Surfliner®. Thousands of visitors use the Santa Barbara Car free discounts every year. The Project received a 2009 national Clean Air Excellence Award from the U.S. Environmental Protection Agency and the Clean Air Act Advisory Committee. Information at: www.santabarbaracarfree.org

In 2009, the San Joaquin Valley APCD adopted a rule that requires larger employers to establish an Employer Trip Reduction Implementation Plan (eTRIP) to encourage employees to reduce single-occupancy vehicle trips, thus reducing pollutant emissions associated with work commutes. The District has also offered a variety of incentive programs aimed at reducing trips, including its REMOVE program. Some of the current REMOVE program trip reduction elements are: E-Mobility (telecommunications); bicycle infrastructure; and public transportation and commuter vanpool subsidies.

Looking Ahead at Trip Reduction – Increased funding for public transit is critical to achieving trip reduction goals. Programs that support car sharing and bike sharing can be encouraged with access to start-up funding, and resolution of liability, safety, and security issues. Local districts can establish and expand employer-based trip reduction programs. Employer resistance to these programs could be lessened with tax and other incentives.

Carbon Free Water by 2015

- 80% reduction in GHG emissions from 2007
- 96% reduction in GHG emissions from electricity use
- One project alone will provide 36 permanent jobs, as well as 94 temporary construction jobs

Water – The Sonoma County Water Agency set a goal in 2006 of operating a

carbon free water system by 2015. To achieve this goal, the Water Agency is helping pioneer new technologies that have been carefully evaluated for economic viability. Examples of some of the energy and sustainability projects, and coordinated program efforts currently under way include:

- Installed a 5 kW wind turbine at the wastewater treatment plant in Geyserville that cost $29,500, and supplies about 7% of the annual power for that service zone;
- Energy efficiency improvements at the Water Agency's administration building, including window film application (saving 30,000 kWh annually in heating and cooling), over 600 light fixture retrofits (saving about 62,000 kWh per year), and 16 LED projects (300 kWh per year);
- Installed three photovoltaic systems that generate 2 MW combined of solar electricity; and
- Planned installation of a Farm-to-Fuels biodigester using local chicken manure to make biogas and nutrient rich fertilizer, fueling a 1.4 MW fuel cell to provide between 25% and 33% of the Water Agency's total base power needs and reduce about 4,000 tons per year of GHGs.

More information can be found at: www.scwa.ca.gov/**carbon**-free-**water**

The Santa Barbara County Green Business Program is a free, voluntary program that offers incentives and assistance to encourage businesses to implement voluntary actions to protect, preserve, and improve the environment beyond what current laws require. Businesses meeting these criteria can be certified as green businesses. The program has roughly 30 partner agencies, utilities and organizations and has certified over 70 businesses since 2008, at a current rate of approximately 20 businesses a year. Additional information can be found at: http://www.sbcapcd.org/biz/greenbizsbc.htm

Santa Barbara Green Business Program

- A hotel in Santa Ynez Valley reduced water use by 10.4%, saving 10.2% in per room water costs. It also reduced electricity use by 6.9%, a cost savings per room of 10%. The hotel estimates it is saving an average of $15,000 to $20,000 a year.
- A real estate management company achieved water cost savings of 41%, electricity cost savings of 25%, and increased waste diversion from 33% to 71%.

Looking Ahead at Water – Local districts can collaborate to identify water strategies that have the greatest reduction potential, or that meet cost effectiveness targets, and develop "toolkits" to make their adoption easier for agencies, businesses, and consumers. Low cost financing would relieve up-front cost pressure, reduce overall project costs, and reduce the pay-back period. Information about the most cost-effective projects could provide the basis for a statewide program or future rule.

Solid Waste – Decomposing waste generates methane, a potent GHG. Waste-to-energy and waste-to-fuel projects take that harmful waste and create useful product, and they displace petroleum fuels. For example, the

Sacramento Waste-to-Fuel

- 25 tons per day of food waste diverted to anaerobic digestion
- 500 diesel gallons equivalent of compressed natural gas for 10 refuse trucks

SMAQMD, through its leadership role with Clean Cities, is working closely with numerous partners in the region to build awareness of the renewable fuel opportunities from the growing volume of organic waste. The District is working to expand the number of organizations and buildings that are separating their organic wastes and diverting it to a local anaerobic digester. Renewable natural gas is available today to the growing number of Sacramento fleets with natural gas vehicles. Through workshops, newsletters, public forums, and outreach opportunities, the District hopes to dramatically increase the volume of renewable fuel produced and used in the region.

Looking Ahead at Solid Waste – Local districts will continue to work with communities and local governments on strategies to increase diversion from landfills. Districts can work with ARB and operators of solid waste sites to identify landfill gas criteria for successful vehicle fuel projects, make project evaluation checklists for waste-to energy projects, and establish best practices for landfill GHG emission reductions to ensure the projects don't interfere with clean air progress and protecting public health. Districts can also provide compliance support for ARB's landfill gas regulation.

Natural & Working Lands – The Placer County APCD is supporting sustainable forest management initiatives to restore the health of California's forest ecosystems and reduce the risk of catastrophic wildfire. Projects involve valuing the wide range of society and environmental benefits that are associated with treating forest fuels and the use of excess biomass for energy and production of biochar. These benefits include significantly improving regional air quality and reducing the risk of the California forests from becoming net emitter of GHGs -- and also protect watershed quality, soil productivity, wildlife habitat, recreational lands, forest resources, provide baseload power and economic support for rural communities, and reduce wildfire suppression costs. These projects directly contribute to the Scoping Plan objective to encourage sustainable activities that protect and maintain current forest stocks through reducing vegetative fuels that could feed wildfires and using this waste for biopower.

Placer Biomass Program

- Used over 20,000 bone dry tons of forest wastes
- Produced 20,000 MWh of renewable electricity
- Reduced 7,000 tons of GHGs, 120 tons of PM, 32 tons NOx, 1,000 tons CO, and 100 tons NMOC (results published in peer-reviewed journal and honored with a 2011 US EPA Clean Air Excellence Award)
- Developed a Biomass Waste for Energy GHG Offset Protocol endorsed by the California Board of Forestry.

The District is leveraging resources and funds from its Clean Air Grant program and Supplemental Environmental Projects, with cooperation and coordination with forest land manager stakeholders including the USFS, CALFIRE, Sierra Nevada Conservancy, local Fire Districts, and industrial timber operators, and research institutions including UC Berkeley, UC Davis, and University of San Francisco.

Specific activities include:

- Demonstrating significant benefits for air pollutant emissions economics using excess biomass wastes for energy.
- Developing a Biomass Waste-to-Energy GHG Offset Protocol.

- Establishing a methodology for and quantifying the air pollutant benefits of selective forest fuels reduction projects for small diameter trees and limbs and brush.
- Assisting development of a regional network to economically collect biomass wastes for energy.
- Assessing the air pollutant emission benefits and economics of distributed forest biomass energy conversion systems in Placer County.
- Supporting development and implementation of energy pricing policies that value the full range of benefits of bioenergy and forest management while balancing ratepayer impacts.
- Technical support for development of small scale distributed energy facilities throughout the Sierra Nevada using excess forest biomass as feedstock and best available control technologies.
- Developing of a Forest Biomass Waste Biochar GHG Offset Protocol.
- Quantifying and determining the impact of black carbon emissions from open pile burning.
- Research to quantify the GHG benefits of reducing catastrophic wildfires.

Looking Ahead at Natural and Working Lands – Stakeholders will continue to work to accelerate the pace of forest fuels reduction projects through establishment of sustainable practices and full monetization of their associated ecological, environmental, and economic benefits. Districts will also continue to work with open space and land managers, as well as parks departments, to identify, quantify, and support land management strategies that increase carbon sequestration.

Vegetation – The SCAQMD has implemented urban tree planting and reforestation projects to reduce GHGs, secure clean air benefits, and provide employment opportunities. The SCAQMDs Tree Partnership program provided funds to help over 30 cities and 2 counties plant urban trees during the economic downturn while providing employment opportunities to students. Under this program over 9,000 California native low biogenic VOC trees were planted and over 500 students were employed. The SCAQMD is also funding an urban tree planting project with the LA Conservation Corps in the area surrounding the Chevron El Segundo refinery. Under this program the Urban Forestry protocol is being followed to identify the types of GHG reductions that be developed under this project protocol. Currently over a thousand trees have been planted by LA Conservation Corps. The SCAQMD is also funding reforestation in the Station Fire burn area of the Angeles National Crest Forest.

South Coast Tree Partnership

- Planted over 400,000 reforestation seedlings with the US Forest Service and the National Forest Foundation
- Employed over 500 students to plant over 9,000 native trees in cities

The Sacramento Metropolitan AQMD developed its “Urban Forest Air Quality Development Program” as a measure in its State Implementation Plan for the federal 8-hour Ozone standard. The program is a targeted urban-forest management program to reduce the total emissions of biogenic volatile organic compounds (BVOC) from urban

trees. Through a combination of community education and governmental policy change over several years, the strategy shifts to the planting of low BVOC-emitting trees rather than medium- and high-emitting trees.

Looking Ahead at Vegetation – Local districts can develop urban tree planting guidelines. Where funding is available, districts can partner with organizations that employ at-risk youth to plant and potentially maintain the trees; this can increase the value of the project for the community, especially for projects employing youth in their own communities.

Appendix D2
Examples of Local Climate Protection / GHG Reduction Efforts

Stationary Sources

Project name: Reducing Black Carbon from Residential Wood Combustion in Sacramento County
Sector: Area Source - Rules
Approximate Date: 2008 – Present (Rules), 2006-2009 (RWC Changeout Program)

Project Description: The Sacramento Metropolitan Air Quality Management District's programs and rules to reduce wood smoke have had considerable climate benefits through reducing black carbon and other aerosols.

Rule 417 requires that new fireplace/stove installation starting 2008 must either be a gaseous fuel-fired unit, a pellet stove, or EPA-certified stoves/inserts.

Rule 421 prohibits wood and other solid fuel burning when PM2.5 concentrations are forecast to exceed the federal health standard during the winter period of November 1st through the end of February. Burning is prohibited except in EPA-certified wood stoves or pellet stoves on Stage 1 No Burn days; all wood-burning activities are prohibited on Stage 2 No Burn days. The annual amount of emission reduction from Rule 421 is 10.91% for fireplaces and 10.29% for woodstoves.

The Residential Wood Combustion (RWC) Changeout program provides monetary incentives for residents living in Sacramento County to replace their old uncertified wood-burning appliances (i.e., wood stoves and fireplaces) with new cleaner-burning ones. From 2006 to 2009, 2,866 RWC units were removed or replaced with gaseous/electric units. About 82% of fireplaces were replaced with gaseous units and 49% of woodstoves/inserts were replaced with gaseous units.

Results achieved: By 2030, the GHG emissions reduction potential from Rule 417 is about 14,000 tons/yr CO2-e; the GHG emissions reduction potential from Rule 421 is about 38,000 tons/yr CO2-e. Current reduction (2005 data) is about 33,000 tons/yr CO2-e. For the RWC Changeout program, the GHG emissions reduction from replacement or removal of 2,866 RWC units is about 1,500 tons/yr CO2-e.

Project name: Check Before You Burn
Sector: Stationary Sources
Approximate Date: Since 2003

Project Description: The San Joaquin Valley APCD has adopted and implemented a precedent-setting residential wood burning strategy, including mandatory no-burn days coupled with a robust incentive program that has already replaced 3,267 wood burning units with gas-fired units throughout the San Joaquin Valley air basin.

Results achieved: Since the implementation of mandatory no-burn days, and wood-burning change-out program, the San Joaquin Valley seen an improvement in PM2.5 concentrations and air quality during the winter season, and has attained the federal 24-hour PM-10 standard. These efforts also generated a significant reduction in carbon black, a potent global warmer.

Project name: Northern Sonoma County APCD – Stationary Source Permitting & Emissions Control
Sector: Stationary Source
Approximate Date: 2011 and ongoing

Project Description: In 2010, in response to the "Tailoring Rule" requirements by U.S. EPA, District staff led a group of federal, state, and local air regulators in the development of a model rule to implement GHG permitting and emissions control thresholds for major stationary sources. The District's version of the rule was approved by the District's Board of Directors and became effective on January 1, 2011.

Results achieved: Under its rule, the District conducted the some of the first permit reviews evaluating and controlling GHG emissions from major stationary sources. Two geothermal power plants were awarded preconstruction permits, and one major modification of a geothermal power plant has also received a permit. As part of the application process, Best Available Control Technology was required to reduce GHG emissions, and the plant proponents were required to provide energy efficiency analyses and plans to minimize operational emissions as well.

Emissions: Inventory Programs

Project Name: Municipal and Communitywide GHG Emission Inventories in San Luis Obispo
Sector: Emissions – Inventory Programs
Approximate Date: 2008 - 2010

Project Description: In 2008, the SLO County APCD Board approved the allocation of grant funds to hire a consultant who prepared emission inventories for municipal operations and communitywide sources for the seven incorporated cities throughout SLO County and develop a comprehensive countywide report on GHG emissions in our region. The city and countywide GHG inventories provide the foundation for policy and program development by estimating baseline emission levels against which future reductions can be measured. By identifying and quantifying the major sources of emissions, they provide valuable insights into where the greatest opportunities for emission reductions lie. This information is instrumental in the development of the GHG Reduction Plans to focus policy and program development on the most cost-effective strategies that best suit their communities. A total of $103,578 from mitigation funds

were used for the completion of the GHG emission inventories for all the cities in SLO County and the compilation of a comprehensive countywide GHG emissions inventory.

Results achieved: The final report of the GHG inventories for both the municipal and communitywide sources for all seven cities were presented to the APCD Board at their 2010 meeting. These inventories were used in the development of Climate Actions by local jurisdictions in San Luis Obispo County.

Project Name: Placer County APCD Climate Action/Greenhouse Gas Reduction Programs
Sector: Emissions - Inventory programs; Natural & Working Lands - Forests & Biomass
Approximate Date: 2006- current

Project Description: Greenhouse Verification Program - Verify GHG emission mandatory reporting and offset project documents.
AB32 ARB Early Action Measures - Provide technical assistance to ensure that emissions reductions proposed by the Scoping Plan are real, permanent and quantifiable, and that data collection and reporting are enforceable. The District has accepted oversight and enforcement responsibility of the CARB Landfill Methane Control Measure and reduction of PFCs from semiconductor regulations.
Climate Action Planning for Local Government Agencies – to assist local governments in developing community scale GHG emission inventories and projections, quantifying emission reductions from various policies and mitigation measures, and developing effective climate protection strategies.

Results achieved:

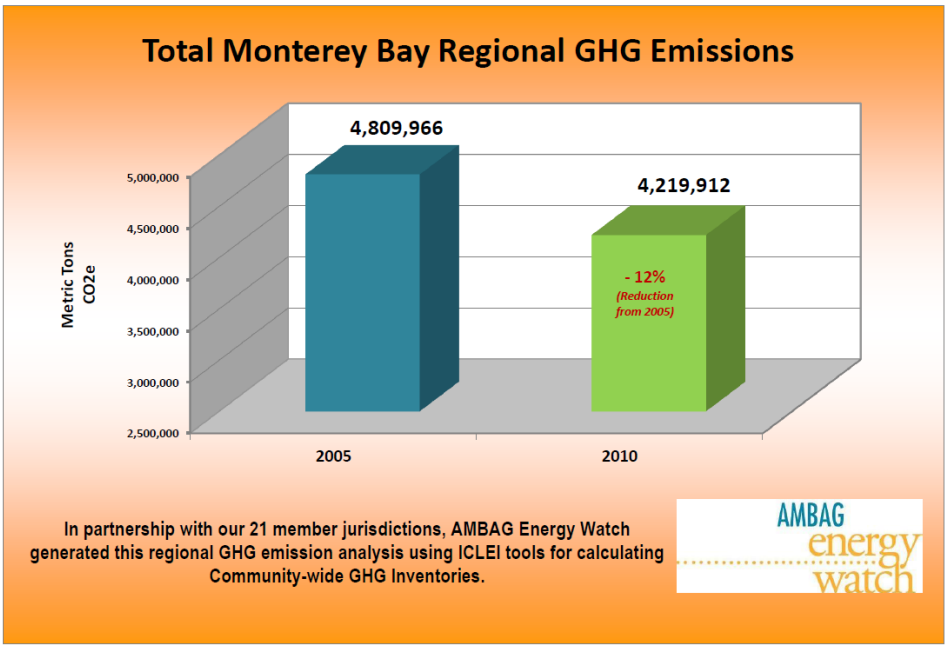
- District is accredited by the CARB as a verification body and with staff accredited as verifiers for the GHG Mandatory Reporting Regulation and the Forestry Compliance Offset Credit Protocol for Cap and Trade Regulation.
- Verification of “qualified” climate action plans which aim to support tiering of future development projects for purposes of CEQA review of GHG impacts include the required standard elements consistent with AB32 goals and the Governor’s Office of Planning and Research (OPR) CEQA Guidelines relating to GHGs.

Project name: Greenhouse Gas Inventories for Local Jurisdictions Prepared by the Association of Monterey Bay Area Governments (AMBAG)
Sector: Emissions – Inventory programs
Approximate Date: Ongoing

Project Description: The Association of Monterey Bay Area Governments (AMBAG) and Pacific Gas and Electric Company (PG&E) partnered to deliver the AMBAG Energy Watch Program, a regional leader in energy efficiency in Monterey, San Benito and Santa Cruz counties. One project implemented by the AMBAG Energy Watch program

was development of greenhouse gas inventories for the Monterey Bay region's 21 jurisdictions. AMBAG completed the following tasks for the 21 local governments:

- Local Government Operations 2005 Baseline GHG Inventories
- Community-wide 2005 Baseline
- Community-wide 2009 and 2010 GHG Inventories
- Periodic updates to Community-wide GHG Inventories for all 21 of AMBAG's member jurisdictions
- Ongoing GHG Inventory technical support and capacity-building for jurisdictional staff.



Results achieved: Completion of community-wide GHG inventories for the 21 local jurisdictions.

Project name: County wide emissions inventories
Sector: Emissions – Inventory Programs
Approximate Date: Since 2011

Project Description: The San Joaquin Valley APCD prepared two state of the art county-wide GHG emissions inventories for Kern and Kings counties to assist those counties in identifying sources of GHG emissions that could be addressed in their upcoming Climate Change Action Plans.

Results achieved: Provided much needed technical assistance to county planning agencies in quantify GHG emissions within their counties and allowing them to identify areas where GHG emissions can be reduced.

Project name: Consolidated Emissions Reporting
Sector: Emissions – Inventory Programs

Approximate Date: 2010 and ongoing

Project Description: The SCAQMD receives criteria and toxic pollutant data for facilities in their jurisdiction that are subject to annual emissions reporting (AER). Many of these facilities are also required to report their greenhouse gas emissions data to the Air Resources Board and the EPA. Reporting emissions data under these three programs utilizes much of the same information. To help SCAQMD facilities consolidate reporting information under these different programs and help provide consistent data reported under all the programs; the SCAQMD modified its AER software. The AER software modification was conducted in part from a grant the SCAQMD was awarded from the EPA to assist facilities in reporting GHG emissions. The modifications to the SCAQMD software help provide awareness of the state and federal GHG reporting requirements, provides a summary of reported information from the AER system which helps with GHG reporting requirements and provides an estimated summary of the facilities GHG emissions.

Results achieved: SCAQMD with help from an EPA grant modified its AER system to help facilities with GHG reporting requirements and provide consistency in information provided across emission reporting platforms.

Emissions: Banking & Trading Programs

Project name: Northern Sonoma County APCD - Greenhouse Gas Emission Reduction Credits
Sector: Emissions – Banking and Trading Programs
Approximate Date: 2013 and ongoing

Project Description: On July 30, 2013, the District's Board of Directors authorized the Air Pollution Control Officer to enter into an agreement with the California Air Pollution Control Officers Association (CAPCOA) to participate in CAPCOA's Greenhouse Gas Reduction Exchange (GHG Rx). The CAPCOA GHG Reduction Exchange (GHG Rx) is an online service that will be operated by CAPCOA and participating air districts. Its goal is to provide a secure, low-cost, high quality greenhouse gas exchange for emission reduction credits created in California. Financial resources invested in state will help create local jobs and realize needed air pollution co-benefits from projects in California. Northern Sonoma staff played a leadership role in the establishment of the CAPCOA GHG Rx, and the District was the first to sign a participation agreement.

The Board also reviewed a proposed Interim Policy under which District staff will review and approve applications for GHG reduction credits; it was approved on September 10, 2013. The Interim Policy establishes consistent procedures for District staff evaluating GHG reduction credits. These procedures ensure the credits issued will be *real*, *permanent*, *quantified*, *validated*, *enforceable*, and *additional*, and protect the integrity of credits that are listed on the CAPCOA GHG Rx. The Interim Policy requires District staff to use the CAPCOA GHG Rx criteria and guidelines to evaluate credit projects. This includes following approved credit project review protocols, and using the common

application forms developed for the GHG Rx. The terms of credit issuance are made enforceable through a legally binding agreement, whose form will be approved by County Counsel.

Under the Interim Policy, there are no fees charged for the review. Staff will propose a formal credit regulation and possibly fees within 18 months.

Project name: County wide GHG emissions inventories
Sector: Emissions - Banking Programs
Approximate Date: since 2012

Project Description: The San Joaquin Valley APCD as part of its Climate Change Action Plan adopted a rule to allow facilities to bank GHG emission reductions. Facilities can then potentially retire such emission reductions to provide GHG mitigation.

Results achieved: The District has issued over 20 GHG emission reduction credits for projects that reduced GHG emissions in the San Joaquin Valley. These credits can now be used by for future mitigation of GHG emissions increases.

Grants & Incentives

Project Name: Placer Air District Incentive Programs
Sector: Grants and incentives
Approximate Date: 2001-current

Project Description:
Technology Assessment Program
The Placer County Air Pollution Control District sponsors a Technology Assessment Program (TAP) to provide financial assistance in the form of grants for the development and evaluation of technologies which have the potential to reduce air pollution in Placer County, with a focus on energy efficiency and waste to energy technologies.

Wood Stove Exchange Program
Concern over the health effects from residential wood burning has been increasing over the past several years. Wood smoke consists of several pollutants, including: carbon monoxide and carbon dioxide, nitrogen dioxide, particulate matter such as black carbon, and other irritating and toxic components. The District provides incentives to home owners in order to help pay for the upgrade from older more polluting wood burning appliances to more efficient units which will reduce the pollution.

Clean Air Grant (CAG)
The PCAPCD Clean Air Grant program provides incentives to projects which are designed to reduce air pollutants such as criteria pollutants and carbon dioxide from mobile sources and other non-regulated sources. Funds used for this program are derived from DMV registration fees and land use air quality mitigation funds.

Results achieved:

- Replacement of 414 non-EPA certified wood-burning appliances;
- 75 on-road and off-road heavy duty engines being repowered, retrofitted, and replaced through the CAG program; and
- $14.4 million in funding has been awarded through the District's CAG program which has reduced approximately 1000 tons of pollutants including GHG since 2001.

Project name: Bay Area Air District Climate Protection Grants
Sector: Grants and Incentives
Approximate Date: 2007

Project Description: In 2007, the Bay Area Air Quality Management District implemented a Climate Protection Grant Program, awarding 53 Climate Protection Grants totaling $3 million to local governments and non-profit organizations in all nine counties of the Bay Area. This one-time grant program was funded from the Air District's general fund. These grants provided critical support to a wide range of projects that helped jump-start climate action planning and project implementation in the Bay Area. The Climate Protection Grants supported climate action in the following program areas:

1) Youth Outreach – engaging youth in promoting personal behavior changes that reduce GHG emissions in their homes, schools and communities.
2) Climate Protection Planning – integrating climate protection into general plans or developing stand-alone climate action plans.
3) Capacity-building – seed funding to establish permanent staffing positions to manage and coordinate energy and climate protection programs.
4) Regionalizing Best Practices – taking strategies that have proven their value at reducing GHG emissions on a small scale and ramping them up for broader application.
5) Fostering Innovation – incubating innovative new projects or policy approaches to reducing GHG.

Examples of activities funded by Climate Protection grants include:

<u>Acterra's Green@home Program</u>
Local resident volunteers are trained in conducting home energy audits and perform "house calls" on local neighbors to assess energy use, water consumption, and house weatherization. Based on the outcome of these mini-audits, the volunteers make recommendations for water and energy use improvements, and even install some devices, such as compact fluorescent bulbs and indoor clotheslines. Green@Home has a strong social marketing component, including lawn-signs that demonstrate a household's participation in the program. A total of 282 house calls were conducted and 63 tons of GHGs reduced.

BerkeleyFIRST
BerkelyFIRST launched the innovative idea of financing energy efficiency and solar PV installations through property taxes. This project served as a model for the statewide CaliforniaFIRST program and other property-assessed clean energy (PACE) programs.

TransForm's GreenTrip Program
TransForm, a land-use planning non-profit organization, developed GreenTrip as a certification program for multi-family, mixed-use development projects to encourage less car-dependence and reduce GHG emissions. Development projects undertake a rigorous certification process that scores a project based on how it supports transit, achieves traffic reductions, and manages parking availability. Since GreenTRIP was launched, 13 projects have been certified representing over 1,900 household units. In total, these GreenTrip certified projects have provided over 80,000 years of free transit passes and 24,000 years of car-share memberships for residents, with an annual savings of 12,715 total tons of CO2. Seven potential new projects are currently being evaluated, totaling another 2,400 units.

Marin Community Choice Aggregation
With its grant, Marin County launched a "Community Choice Aggregation" program, called Marin Clean Energy (MCE), which aggregates the electricity purchasing for business and residential electric customers throughout the County. PG&E continues to provide transmission, billing and maintenance and repair services to Marin customers, but MCE purchases electricity through third parties. By doing this, MCE can ensure that the electricity used by Marin County customers is 50-100% renewable. Most of the electricity purchased by MCE is wind, but also biomass and biowaste, solar and hydro. MCE has signed contracts to purchase over 70 megawatts of new renewable energy that will be built in California and is working on plans to significant solar projects in Marin County. Since 2010, Marin's Clean Energy program has reduced over 28,000 tons of GHGs.

Seed-funding Climate Staff
One of the most innovative approaches in the Air District's Climate Protection Grant Program was to provide grants to seed-fund permanent climate staff positions in local governments. Seven positions were funded throughout the Bay Area. These staff developed climate action plans and implemented many energy and water saving projects. As a result, these positions have become self-funding and all are still in place today.

Results from Climate Protection Grant Program (as reported by all grantees):

- Funded 21 local climate action plans and climate elements in general plans, creating a surge of climate action planning in the Bay Area
- Reduced over 54,000 tons of GHGs
- Created over 100 permanent and temporary jobs for adults and youth
- Over 500 public meetings convened, serving over 25,000 participants
- Over 7,000 youth actively engaged in climate protection

Project name: Northern Sonoma County APCD – Climate Protection Grants
Sector: Grants & Incentives
Approximate Date: 2009 and ongoing

Project Description: In 2009, the District's Board of Directors established a Climate Protection grant program, funded with a portion of the District's revenues from a surcharge on motor vehicle registration, to support education, outreach, and demonstration projects in reduction of GHG emissions associated with motor vehicle use. The District also implements a Community Program Fund, to address community concerns about air pollution, funded with penalties received from violations of air quality requirements, and other miscellaneous revenues. Some of the climate protection projects funded from these two grant programs include:

- Cool Schools – eCO2commute Student Trip Reduction Module for Healdsburg High School, with the Sonoma County Climate Protection Campaign. The CPC was funded to develop an educational module and provide implementation support for Healdsburg High School to offer a course in the development, implementation, tracking and analysis of a program to change student commute patterns. 2009
- Cool Schools – Waste Reduction Module at El Molino High School, with the Sonoma County Climate Protection Campaign. The CPC was funded to develop an educational module and provide implementation support for El Molino High School to offer a course in the development, implementation, tracking and analysis of a program to change student and faculty behavior surrounding waste, recycling, and composting. 2010

- CAPCOA Climate Change Forum – Conference in San Francisco, focusing on green business, effective land use strategies, the economics of climate change, and future challenges and opportunities. 2010
- Climate Protection: Everybody Profits – Conference in Sonoma County focused on preserving Agriculture in the face of climate change. 2011
- Strategies for Sustainability – City of Santa Rosa conference to engage and provide resources for local governments, businesses, and community leaders engaging in greenhouse gas reduction efforts, and climate adaptation. 2012
- CAPCOA GHG Reduction Exchange – Creation of an online service that will be operated by CAPCOA and participating air districts. Its goal is to provide a secure, low-cost, high quality greenhouse gas exchange for emission reduction credits created in California, create local jobs and realize needed air pollution co-benefits from projects in California. 2013
- Sonoma County Climate Action 2020 – Environmental review of the comprehensive GHG reduction implementation plan for the County and its cities. 2013

- Woodstove Changeout Program – The District is offering its third woodstove changeout program, providing rebates to residents who replace old, dirty woodstoves with cleaner, more efficient alternatives.

Project name: Care for Our Earth Teacher Grant Program
Sector: Grants and Incentives
Approximate Date: 2011 to present

Project Description: The Santa Barbara County Air Pollution Control District, in partnership with the Santa Barbara County Education Office and local utility companies, has for the last four years offered mini-grants of $200 each to teachers for educational programs that aim to save energy, cut traffic and pollution, or save water. For 2013, another program partner was identified, the grant amount was increased to $250, and a higher grant tier was added for more extensive projects.

Web links:
http://www.sbcapcd.org/teachers.htm
http://www.sbceoportal.org/teacherprograms/care-for-our-earth-grants/

Results achieved: In 2012, 26 grants were issued to 9 school districts; in 2011, 22 grants were issued to 9 school districts; and, in 2010, 15 grants were issued to 9 school districts. Examples of projects funded by these grants include:

- At Pine Grove Elementary School in Orcutt, fifth graders formed a "Power Down Patrol" to inspects classrooms at breaks to be sure lights and equipment were turned off.
- Students at Carpinteria Family School learned from Bici Centro and the Santa Barbara Bicycle Coalition how to ride safely and legally in traffic.
- Students at Righetti High School in Santa Maria produced articles, songs and other materials on the subject of pollution and global warming.
- Seventh graders at Vista de Las Cruces School in Gaviota calculated energy use for computer equipment and designed a program to save energy.

Project name: Grants for Integrated Alternative Transportation and Renewable Energy
Sector: Grants & Incentives
Approximate Date: 2012 and ongoing

Project Description: SCAQMD has funded several innovative projects that provide energy storage for new renewable energy generation used to support electric transportation. These include significant investments in:

(a) City of Industry for installation of up to 2MW for a solar PV carport, 64 Level 2 EV chargers and a fleet of electric vehicles to be used in a car-sharing program at the City of Industry's Metrolink train station;
(b) CODA Energy LLC for the installation of up to 50kW for a solar PV rooftop system, 1.5MW battery energy storage system and the installation of 10 Level 2 EV charge stations at their Santa Monica facility;

(c) Siemens Industry, Inc. for the installation of up to 632 kW for solar PV carports, as part of a larger power-purchase agreement project with El Monte Unified School District with integrated electric charging stations and SmartGrid integration;
(d) Kinetic Traction Systems for the installation of up to 1 MW of flywheel energy storage to provide regenerative braking to trains and up to 2 kW of solar PV at LACMTA's Gold Line facility;
(e) UCR CE-CERT for the installations of up to 2 MW of solar PV and up to 2 MWh of lithium battery storage systems to facilitate EV charging sites throughout the City of Riverside and convert an existing diesel trolley to electric drive to link the campus and various city sites to the Metrolink station;
(f) OHR Energy for the installation of up to 1.4 MW of renewable fuel cell energy, an absorption chiller, EV chargers and the potential of energy storage;
(g) Eastern Municipal Water District for the installation of up to 300kW of renewable fuel cell energy at its Perris Valley Water Reclamation Facility; and,
(h) UTC Power for the installation of up to 400 kW of renewable fuel cell energy at one Albertson's Supermarket, an absorption chiller and up to six EV chargers.

Results achieved: These demonstration projects integrating renewables and battery storage help provide a path forward towards the challenges of addressing intermittency with renewables, helps integrate electric vehicles onto the grid, and helps reduce power needs during peak demand periods which is often supplied from inefficient fossil peakers.

Project name: Various San Joaquin Valley Incentive Programs
Sector: Grants and Incentives
Approximate Date: Since 1992

Project Description: Since 1992, the San Joaquin Valley APCD has spent over $500 million on a wide variety of voluntary incentive programs, leveraging another $500 million from program participants for a total investment of more than $1 billion in clean-air projects in the Valley. From lawnmower replacement programs, transit projects and VMT reduction efforts to light-duty vehicle repair programs and heavy-duty diesel engine replacement programs, the District has been successful in reducing both criteria pollutants and greenhouse gases. The District's has successfully replaced or retrofitted thousands of heavy-duty diesel–powered units with newer, low-emission equipment, including: on-road trucks, off-road equipment, school buses and agricultural irrigation pump engines.

Since 1992, the San Joaquin Valley APCD has provided funding to Valley residents and businesses to assist in not just bringing alternative fuel vehicles to the region, but reducing vehicle miles traveled.

The District's Remove II program has provided financial incentives for projects that reduce emissions from light-and-medium duty motor vehicles; promotes new technologies that reduce vehicle miles traveled; and promotes alternative transportation measures. The current Remove II program components include: E-Mobility

(Telecommunications); Bicycle Infrastructure; Public Transportation and Commuter Vanpool Passenger Subsidy; Alternative Fuels Mechanic Training; Light-and-Medium-Duty Vehicles (Drive Clean! Rebate Program); Polluting Automobile Scrap and Salvage Program.

In 2011, the District began providing incentive funding for Advanced Transportation and Alternative Fueling projects to public agencies and public educational institutions located within the geographic boundaries of the San Joaquin Valley air basin through its Public Benefit Grants Program (PBGP).

Results achieved: The San Joaquin Valley APCD's incentive programs have garnered substantial greenhouse gas reductions through the elimination of over 4,500 tons of particulate matter (black carbon). In addition, the San Joaquin Valley APCD focuses significant resources and funding towards the electrification of equipment such as agricultural irrigation pump engines which have substantial greenhouse gas benefits.

The San Joaquin Valley APCD's Ag Pump Electrification Program is a partnership with the agricultural industry and the local electric utilities (PG&E/SCE). This program replaced over 2,000 diesel agricultural irrigation pump engines with electric motors. As a result this program resulted in more than 400,000 tons of CO2e.

Project name: Technology Advancement Program
Sector: Grants and Incentives
Approximate Date: Since 2010

Project Description: The San Joaquin Valley APCD adopted its Technology Advancement Program to encourage the next generation of emissions reducing technologies. The program focuses on mobile sources, waste solutions, and renewable energy and has funded projects including truck and tractor electrification and hybridization, as well as waste gas projects including renewable natural gas for vehicle fuels projects. The projects selected work to bring new technologies and processes from the demonstration phase to being ready for commercialization and deployment in the broader market.

Results achieved: San Joaquin Valley APCD's Technology Advancement Program:

- Focuses on Mobile Sources and Renewable Energy
- Actively seeks projects with greenhouse gas reductions, and considers greenhouse gas benefits in project selection.
- Program has awarded funding for 8 heavy-duty on- and off-road mobile hybridization and electrification projects for over $2.7 million
- Program has awarded funding for 6 biogas projects for over $2.3 million including biogas-to-fuel projects

Outreach & Education

Project name: Healthy Air Living Schools Program

Sector: Outreach – guidance and training
Approximate Date: Since 2012

Project Description: The San Joaquin Valley APCD, in partnership with local school districts and asthma coalitions, has developed the Healthy Air Living Schools program designed to reduce traffic and vehicle idling around school sites. Most students in San Joaquin Valley schools live within one mile of their school campus, yet 43 percent of these students are driven to school in private vehicles. Through the Healthy Air Living Schools Program, the San Joaquin Valley Pollution Control District hopes to reduce both school related vehicle-miles-traveled and school site vehicle idling, which in turn reduces greenhouse gases and improves student health.

Results achieved: The Healthy Air Living Schools Program provides free to any school in the San Joaquin Valley Air Basin the following:

- Education and training to school staff regarding the effect of vehicle traffic and idling on students.
- Bilingual educational materials and small incentives to schools for distribution to parents regarding the effects of vehicle traffic and idling on air quality & children's health.
- "No-Idling" signs for schools to use where parents pick up students after school.
- Access to the District's Real-time Air Advisory Network system.
- Air Quality Education Curriculum Kits.
- Information assisting parents in finding alternative transportation options such as *Safe Routes to Schools*, the *Walking School Bus* and *Bicycle Rodeos*.
- Information encouraging teacher's to apply for the Healthy Air Living Schools teacher mini-grant program to fund small classroom projects related to idling and air quality.

Project Name: Climate Change Outreach
Sector: Outreach – Materials, conference, websites
Approximate Date: 2006 - present

Project Description: As defined in the SLO County APCD's Climate Change Program adopted by our Board in 2005, working with local governments to join the Cities for Climate Protection program and expanding public awareness on climate change are critical components to reduce our region's carbon footprint. Since 2006, the APCD's Annual Outreach Plan has defined programs, desired outcomes and strategies to assist cities and county agencies, coalition partners and the general public in efforts to reduce GHG emissions to meet the goals of AB 32. Key outreach programs include 1) Central Coast Clean Cities Coalition (C5) that promotes the use of alternative fuel vehicle technologies; 2) Food Miles Campaign to preserves local agricultural operations and reduce vehicle miles traveled (VMT) in transporting food to and from our county; 3) SLO Car Free program that provides incentives for car-free, care-free visitors coming to the Central Coast; and 4) Energy Awareness program implemented in partnership with the County of San Luis Obispo in increase public awareness of the environmental and cost-saving benefits of reducing energy use and switching to renewable energy sources.

Results achieved: San Luis Obispo County has received an official "Clean Cities" designation as a result of the significant efforts of the C5 group to promote clean fuels use in our county. The SLO Car Free website received over 10,000 unique visitors in the past year alone, and over 2,000 people have registered to travel to SLO without their car. The APCD has partnered with SLO County for the past 2 years in sponsoring a countywide "Energy Event" to promote energy conservation and renewable energy.

Project name: Electric Vehicle Initiative – Infrastructure Guidelines
Sector: Outreach – Guidance & Training
Approximate Date: 2012

Project Description: The Northern Sonoma County APCD worked with Sonoma County Fleet Operations, Permit Resource Management Department, Risk Management, County Counsel's office, the Sonoma County Water Agency, the Sonoma County Regional Climate Protection Agency, and others to develop guidelines for the permitting and installation of electric vehicle charging infrastructure. These guidelines served as a model for the subsequent development of guidelines by the California Plug-in Electric Vehicle Collaborative, as well as draft interim guidelines from the Governor's Office of Planning and Research, both of which efforts District staff played a role in. Guidelines available at www.pevcollaborative.org

Project name: High School and Senior Citizen Conferences
Sector: Outreach and Education
Approximate Date: Ongoing from 2010

Project Description: The SCAQMD has held several conferences for high school students to promote the benefits of clean air and the mission of the agency. Topics included relevant information on air quality, respiratory health and clean air tips for the home, family and community; and exhibits and clean vehicle displays. GHGs were also discussed at the 2013 High School conference, such as the Alliance for Climate Education (ACE) gave a presentation on Climate Change. Global Inheritance had two interactive exhibits in the Expo Hall to educate students about energy choices and their effect on the environment (climate change and criteria pollutants). Two conferences were held for high school students in 2010 and 2013. 8,000 students attended the 2010 conference, and 7,000 attended the 2013 conference. Additionally, SCAQMD participates in other school educational conferences, such as JPL Climate Day, for climate change and air quality.

Results achieved: Outreach to high school students and residents to provide education that enable conference attendees to make choices that benefit air quality and greenhouse gas emissions.

Plans

Project name: 2012 Metropolitan Transportation Plan and Sustainable Communities Strategy

Sector: Plans
Approximate Date: 2012

Project Description: In December of 2012, the Butte County Association of Governments (BCAG) Board of Directors approved the areas first Sustainable Communities Strategy (SCS) as a component of the 2012 Metropolitan Transportation Plan (MTP). The 2012 MTP/SCS sets forth a plan to reduce the Butte County regions per capita greenhouse gas emissions from passenger vehicles by 2% for the years 2020 and 2035, from 2005 levels. These reductions are achieved by integrating the areas land use, housing, and transportation in a manner that reduces per capita travel and emissions from passenger vehicles, while managing an estimated increase of 110,000 persons, 47,000 new housing units, and 41,000 additional jobs.

Project name: 2012 City of Chico Climate Action Plan
Sector: Climate Action Plan
Approximate Date: 2012

Project Description: The City of Chico adopted their Climate Action Plan (CAP) in November 2012 which establishes a goal to reduce greenhouse gas emissions (GHG) by 25% by 2020. The CAP is a strategy for Chico to grow in a sustainable way that meets GHG reduction goals while continuing to allow for the public and private development and redevelopment that will keep Chico a vibrant and livable community. The City General Plan policies incorporated into the plan include reducing community-wide greenhouse gas emissions through various actions in the transportation, energy, and waste sectors.

Project name: City of Gonzales Climate Action Plan
Sector: Plans – Climate Action Plan
Approximate Date: Ongoing

Project Description: The City of Gonzales adopted their Climate Action Plan in February 2013. The plan is a product of the “Gonzales Grows Green” Sustainable Community Initiative, an outgrowth of the City’s Vision Statement adopted in 2005. The plan provides energy use, transportation, land use, water use, and solid waste strategies to reduce Gonzales’ greenhouse gas emissions levels to 15 percent below 2005 levels by 2020.

Project name: Monterey Region In-Progress Local Climate Action Plans
Sector: Plans – Climate Action Plans
Approximate Date: Ongoing

Project Description: The counties of: Monterey, San Benito and Santa Cruz and the cities of: Capitola, Monterey, and Watsonville are in the process of developing Climate Action Plans.

Project name: City of Santa Cruz Climate Action Plan

Sector: Plans – Climate Action Plan
Approximate Date: Ongoing

Project Description: The City of Santa Cruz adopted their Climate Action Plan in June 2012. The plan is a strategy for Santa Cruz to grow in a sustainable way that meets GHG reduction goals while continuing to allow for the public and private development and redevelopment that will keep Santa Cruz a vibrant and livable community. The City General Plan policies incorporated into the plan include reducing community-wide greenhouse gas emissions 30 percent by 2020 and 80 percent by 2050 and for all new buildings to be emission neutral by 2030.

Project Name: Cities of San Luis Obispo County Climate Action Plans
Sector: Plans
Approximate Date: 2011 - 2014

Project Description: In November 2011, the SLO County APCD Board approved a three-party funded project for the development of the GHG Reduction Plans for six cities. The County of San Luis Obispo and the City of San Luis Obispo used federal stimulus funds to develop and complete their Climate Action Plans in 2011 and 2012 respectively. By collaborating with Pacific Gas & Electric and the Southern California Gas Company, the APCD was able secure a total of $405,018 for the development of climate action plans for the remaining six cities in our region. Through a collaborative effort, a consultant updated the emissions inventory and 2020 forecast, completed a gap analysis, developed GHG reduction measures, developed individual city climate action plans and conducted public outreach for each of the six cities. Draft plans are currently developed and the project is near completion. Through the APCD's City/County GHG Stakeholder Committee, agency staff will work on plan implementation as well as seeking to secure additional grant funding for program implementation.

Results achieved: The County and the City of San Luis Obispo have approved Climate Action Plans that are currently being implemented. The remaining six cities have draft (soon to be final) climate action plans that are scheduled to go before their Councils for consideration by the end of the year. These plans serve as a roadmap for each local jurisdiction to meet the AB 32 goals of reducing GHG emissions to the 1990 levels by 2020.

Project name: Sustainable Community Strategies under Development by the Association of Monterey Bay Area Governments (AMBAG)
Sector: Plans – Transportation Land Use/location strategies
Approximate Date: Adoption expected in June 2014

Project Description: AMBAG is currently developing Sustainable Community Strategies (SCS) to meet the regional greenhouse gas (GHG) targets reductions from the automobile and light truck sectors for 2020 and 2035. The preferred SCS scenario was approved by the AMBAG Board in September 2013. The scenario includes mixed

land use to support transit infrastructure, encourages economic development and growth, and has been evaluated to ensure regional and inter-county consistency. The final Metropolitan Transportation Plan/SCS and accompanying Environmental Impact Report is scheduled for adoption in June 2014.

Project Name: Preliminary Sustainable Communities Strategy
Sector: Plans
Approximate Date: 2009 – 2010 & 2013 - 2014

Project Description: In 2010, the SLO County APCD was involved in the San Luis Obispo County Council of Governments (SLOCOG) early efforts to develop a *Preliminary Sustainable Communities Strategy (PSC)* as part of the 2010 Regional Transportation Plan (RTP). The RTP is a comprehensive plan guiding transportation policy for the region and makes recommendations concerning improvements to the existing transportation network of highways, transit, air and water, rail and bicycling. The integration of a PSCS into the 2010 RTP provided local jurisdictions the opportunity to become acquainted with the requirements of SB 375 to determine methods to reduce GHG emissions through decreased vehicle miles traveled as a result of a comprehensive intermodal transportation investment strategy. The PSCS was approved as part of the 2010 RTP and demonstrated an eight percent (8%) reduction in GHG emissions. The PSCS is currently serving as the roadmap for SLOCOG in their official efforts to implement requirements of SB 375 in the 2014 RTP. Once approved by SLOCOG Board, the SCS will be forwarded to ARB for evaluation and determination if the plan will achieve the GHG emission reduction targets.

Results achieved: Through the development of the PSCS, SLOCOG was able to demonstrate an achievable GHG emission reduction of eight percent (relative to 2005) for the 2020 and 2035 target dates of SB 375.

Project name: Climate Change Action Plan
Sector: Climate Action Plan
Approximate Date: Since 2008

Project Description: In August 2008, the San Joaquin Valley APCD adopted its Climate Change Action Plan. This plan led to the development of guidance to assist Lead Agencies, project proponents, permit applicants, and interested parties in assessing and reducing the impacts of project specific GHG emissions on global climate change.

As part of the its Climate Change Action Plan the San Joaquin Valley APCD developed numerous Best Performance Standards for stationary sources and development projects that identify mechanisms for projects to reduce their GHG emissions to levels such that their GHG emissions are not significant for purposes of CEQA review, streamlining the CEQA review process while avoiding hundreds of thousands of tons of GHG emission increases.

Results achieved: The San Joaquin Valley's Climate Change Action plan has resulted in a streamlined approach to addressing GHGs as part of the CEQA review process and has resulted in hundreds of thousands of tons of avoided GHG emissions.

Project name: San Mateo County Regionally Integrated Climate Action Planning Suite (RICAPS)
Sector: Climate Action Plans (Tools)
Approximate Date: 2010

Project Description: Climate action planning is a complex process that can be cost prohibitive for cities to undertake on their own. Because of this, the San Mateo City and County Association of Governments (C/CAG), with support from the Bay Area Air Quality Management District and PG&E, has developed the Regionally Integrated Climate Action Planning Suite (RICAPS) to aid cities and towns in San Mateo County in developing their own climate action plans. RICAPS is a suite of tools aimed at streamlining and facilitating the climate action planning process. The RICAPS tools include:

- Climate Action Plan Template – a 60 page document that contains all of the elements necessary to create a robust climate action plan
- Manual of Calculations of Proposed Measures – a menu of 40 potential GHG reduction measures to include in the climate action plan, with county-based assumptions that produces estimated GHG reductions, and financial costs and benefits for each measure
- Online Calculation and Measurement Tool – a databank to input and store the key data and assumptions for each measure, as well as keep track of your progress over time

To complement the RICAPS tools, the C/CAG has set up a Multi-City Working Group that meets monthly to share information and coaching on how to implement each stage of the climate action planning process.

Results achieved:

- So far, six local climate action plans have been developed and adopted using the RICAPS tools
- Four additional climate action plans are in advanced stages of development

Project name: City of Santa Barbara Climate Action Plan
Sector: Climate Action Plans
Approximate Date: Adopted September 18, 2012

Project Description: The City of Santa Barbara's Climate Action Plan (Plan) identifies a communitywide greenhouse gas emissions inventory and forecasts future emissions generation. Strategies to reduce carbon dioxide and other greenhouse gas emissions are identified in the areas of energy, travel and land use, vegetation, waste reduction, and water conservation. The Plan also provides an overall assessment of Santa

Barbara's vulnerability to climate changes and identifies strategies to begin planning for adaptation to climate change effects.

Web link:
http://www.santabarbaraca.gov/services/planning/mpe/climate.asp

Results achieved: The plan identifies carbon emissions targets for the years 2020 and 2030 consistent with established State and regional targets, and with City General Plan policies directing sustainability and climate protection measures. The analysis finds that with identified strategies, reduced emissions would meet and surpass state emissions targets for overall emissions level in the year 2020 (1990 emission level), and vehicle-related emissions in 2020 and 2035 (2005 emission level).

The plan provides for monitoring and reporting on the implementation of action measures for carbon emissions reduction and adaptation planning. Updated reports on the citywide carbon emissions inventory and climate change information will be provided every 5 years, and the entire plan is slated to be updated in 2030.

Project name: GHG mitigation through local planning and development
Sector: Climate Action Plans / General Plans Transp.- Land Use/location strategies
Approximate Date: Continuous

Project Description: The SMAQMD has been actively involved in local government efforts to incorporate GHG mitigation into planning and land-use development, working through both informal partnerships and CEQA.

The SMAQMD has worked with all local jurisdictions within the air district to develop Climate Action Plans. Adopted plans include Elk Grove (2013), Citrus Heights (2011), City of Sacramento (2012) and County of Sacramento (govt. sector, 2011); plans in development include County of Sacramento (community sector) and City of Folsom. In addition, SMAQMD staff has worked with both the City and County of Sacramento to develop project-specific thresholds of significance for GHGs to limit emissions from new developments.

In its role as a commenting agency through CEQA, the SMAQMD has also successfully motivated local jurisdictions within Sacramento County to address climate change impacts in new developments (e.g. Cordova Hills, Southeast Connector, Elverta SPA, Aspen 1, etc.). Specific GHG emission reduction strategies have included energy efficiency (e.g. tankless water heaters), renewable generation (on-site solar), transportation demand management (transportation management agency memberships, on-site ride-matching, employee transit subsidies, guaranteed rides home for alternative transportation users, etc.), and design and infrastructure improvements (e.g. sidewalks, bike lanes, more connectivity).

The air district is also a founding member of the Sacramento Area Climate Partnership, which has led to collaborations with the Sacramento Municipal Utility District and local

jurisdictions on climate action planning efforts (such as developing a baseline inventory for climate action planning and potential GHG reduction measures). The SMAQMD has also been working with the other air districts within the Sacramento Federal Nonattainment Area to develop regional thresholds of significance for GHG emissions. The SMAQMD also produces and updates a *Recommended Guide to Land Use Emission Reductions* that incorporates CalEEMod and GHG mitigation measures for use by project proponents.

Project name: Transportation Plan/Sustainable Communities Strategy (MTP/SCS 2025)
Sector: Plans
Approximate Date: 2012 - 2035

Project Description: The Transportation Plan/Sustainability Communities Strategy for 2035 (MTP/SCS) is an important evolutionary milestone along the path towards inclusive, equitable, performance-based planning that the Sacramento Council of Governments (SACOG) began about a decade ago. As the Sacramento region's first MTP/SCS adopted under Senate Bill 375, this plan has many unique features to link regional growth patterns, smart land-use principles, and the transportation system. One key feature includes reductions in per-capita passenger vehicle greenhouse gas emissions that exceed the minimum targets established for the SACOG region by the California Air Resources Board.

Results achieved: Below are the areas in which reductions will be realized from the Scoping Plan for 2020, and SACOG's contribution toward those reductions:

Proposed MTP/SCS Plan Area Share of Scoping Plan Measures (MMtCO2e)

Transportation – Includes Fuel Efficiency, Low Carbon Fuels, etc.	1.902
Electricity Efficiency – Includes Million Solar Roofs, and Building and Appliance Efficiency	1.72
Natural Gas Efficiency – Includes Solar Hot Water, and Building and Appliance Efficiency	0.25

Sources: California Air Resources Board (ARB) 2010. 2020 Greenhouse Gas Forecast Methodology Retrieved July 2011 and SACOG (2011). MTP/SCS.

Project name: Sonoma County Regional Climate Protection Authority - Climate Action 2020
Sector: Plans – CAP
Approximate Date: 2013 - 2015

Project Description: Climate Action 2020 is a collaborative effort among all 9 cities and the County of Sonoma to take further actions in reducing GHG emissions community-wide and respond to the threats of climate change. RCPA will work with communities to develop a comprehensive and detailed plan for each jurisdiction that will identify measures to reduce GHGs from sources including building energy (electricity and natural gas), transportation, water use and transport, waste, wastewater and agriculture. This detailed plan is called a Community Climate Action Plan, and known locally as Climate Action 2020.

A main goal of Climate Action 2020 is to identify specific, implementable actions that each jurisdiction can take to ensure their communities remain vibrant and resilient in an ever changing climate. Overall, Climate Action 2020 will benefit Sonoma County communities by providing a comprehensive assessment of GHGs and emissions-reduction strategies. Since each community within Sonoma County is unique, each community is going to have different concerns and priorities within their community.

Project Name: Land Use Planning & California Environmental Quality Act (CEQA)
Sector: CEQA
Approximate Date: 1996 – Continuous

Project Description: As a commenting agency, the Sacramento District provides assistance to local jurisdictions on land use development projects subject to the California Environmental Protection Act (CEQA) to help reshape and guide community land use decisions toward sustainability and quality of life. To mitigate the project's related GHG emissions, the District assists lead agencies in determining when and how

new development can mitigate GHG impacts to avoid or lessen significant impacts on the environment and public health. The District provides recommendation of measurable standards and mitigation to reduce construction- and operational- related pollutant emissions.

In addition to working with ARB for the proposed statewide programs and regulations, the District is working with other local air districts in Sacramento area to develop a Sacramento regional GHG significant threshold for land use development projects and being in the development commitment to develop the GHG mitigation quantification guidance under CAPCOA Board's direction.

Results achieved:

- Verification of the adequacy of GHG analyses prepared for land use development;
- Mitigation measures are recommended to reduce potential GHG impacts from land use development project;
- Verification of emission reduction claims resulting from State mandated programs and proposed mitigation measures; and
- Coordination with participating air districts under CAPCOA direction to develop the GHG mitigation quantification guidance.

CEQA

Project Name: GHG CEQA Thresholds of Significance for Proposed Land Use Projects
Sector: CEQA - Multiple (Stationary Sources, Transportation & Energy)
Approximate Date: 2012

Project Description: The SLO County APCD's CEQA Air Quality Handbook serves as a guide for evaluating and mitigating the potential air quality impacts of projects subject to review under the California Environmental Quality Act (CEQA). In March 2012, the SLO County APCD Board adopted GHG CEQA Thresholds of Significance for residential, commercial and industrial projects, to assist lead agencies in determining the significance of GHG emission impacts from new land use projects subject to CEQA review. Adoption of significance thresholds eliminates the need for projects below the thresholds to quantify and mitigate GHG emissions, provides consistency and more certainty to the review process, and helps our region contribute its fair share toward meeting the statewide GHG reduction targets mandated by AB 32.

Results achieved: The CEQA greenhouse gas thresholds were approved by our Board in March 2012 and currently the County and seven cities in our region are implementing the thresholds. Implementation of the thresholds by lead agencies in SLO County is expected to reduce overall costs for new land use development by streamlining the review process for smaller projects and reducing the number of projects subject to GHG analysis and mitigation requirements.

Energy

Building Energy Efficiency & Lighting

Project name: Acterra Green@Home Program
Sector: Energy – Building Energy Efficiency
Approximate Date: 2007

Project Description: Acterra is a non-profit organization that provides hands-on program activities to reduce the environmental impact of communities in the Silicon Valley area. Acterra's developed the Green@Home program to implement local strategies that increase the energy efficiency of residential buildings. The program is free, provides home energy assessments to residents of Santa Clara County and offers online software that enables participants to create a personalized analysis of their homes' overall energy use. The software also provides recommendations on how to increase household energy efficiency that result in financial savings to the consumer. Acterra is currently implementing the Green@Home program with partnerships in the Cities of Palo Alto, Mountain View, Menlo Park, Cupertino, and Sunnyvale. Local resident volunteers are trained on conducting household energy audits and creating awareness of sustainable living practices. Personal 2-hour house visits from locally trained neighborhood volunteers are scheduled to assess energy use, water consumption, and house weatherization. Based on the outcome of these audits, the volunteers make recommendations for water and energy use improvements, and even install some devices, such as compact fluorescent bulbs and indoor clotheslines. Green@Home also has a well-designed marketing component that promotes energy saving through consumer behavior, including: yard-signs for all participants, commitments to use reusable shopping bags, informational handouts, and support groups to share ideas, raise questions, or give referrals to contractors and product vendors.

Results achieved: Through its city partners and local residents, Acterra's Green@Home program has been effective at heightening public awareness, increasing participation, and creating local solutions to climate change, which include:

- 1,500 home energy audits conducted
- 450 trained neighborhood volunteers with 8,400 hours in the field
- Providing custom home energy saving plans
- Strategy integration into local climate action plans
- Household savings of $50 to $150 per year in energy efficiency and becoming energy conscious
- Program resulting in GHG reductions of 680 metric tons per year

Project name: Energy Action Strategies for Local Jurisdictions Prepared by the Association of Monterey Bay Area Governments (AMBAG)
Sector: Energy
Approximate Date: Completed

Project Description: AMBAG Energy Watch has developed draft Energy Action Strategy plans for the local jurisdictions to quantify and reduce residential and non-residential energy consumption and related GHG emissions. These standalone plans provide analyses of annual energy consumption patterns and contain a range energy efficiency and conservation initiatives that are feasible and appropriate within each unique community. For those jurisdictions who ultimately decide to develop and adopt comprehensive Climate Action Plans, the initiatives comprising the Energy Action Strategies can be easily and efficiently integrated into the energy chapter(s) of the Climate Action Plans.

Project name: Energy Efficiency Programs Implemented by the Association of Monterey Bay Area Governments (AMBAG) Energy Watch Program
Sector: Energy – building energy efficiency
Approximate Date: Ongoing

Project Description: AMBAG Energy Watch and PG&E provide rebates and incentives for projects that reduce energy use. Recently, AMBAG launched a program directed at improving energy efficiency for local agricultural businesses. AMBAG Energy Watch also installs energy efficient equipment at non-profits, school districts, special districts, municipal facilities, and hospitality facilities.

Results achieved: As of September 2013, the combined direct installation program, including the agriculture pilot, has installed equipment projected to generate annual energy savings of 1,116,393 kWh.

Project name: Home Energy Conservation Program
Sector: Energy – Building energy efficiency
Approximate Date: 2012-ongoing

Project Description: The SMAQMD collaborated with Sacramento Association of REALTORS® (SAR), Rebuilding Together Sacramento, Sacramento Habitat for Humanity, and the University of California Davis School of Civil and Environmental Engineering to tackle the problem of weatherizing housing for low-income residents in the Sacramento Region. The Home Energy Conservation Program improves comfort, safety, and health for residents, saves energy and money, and achieves significant reductions in GHG emissions. Beginning in April 2012, the program has upgraded over 100 single-family homes. To date, most of the homes have been in low-income neighborhoods within the City of Sacramento.

Using a combination of paid and volunteer workers, Rebuilding Together Sacramento and Sacramento Habitat for Humanity perform Tier 1 weatherization upgrades that include installing compact florescent lights, weather stripping, window caulking, outlet sealers, water heater blankets, water heater pipe insulation, and low-flow showerheads. Cost-benefit analysis was used to select weatherization components that delivered the greatest GHG emissions reductions for the least cost.

The University of California, Davis, evaluates data on weatherized homes to quantify energy savings. GHG emissions reductions are estimated at approximately one ton per year per home. The total cost per home including materials, labor, and administrative overhead averages $300. Residents are also provided information on other energy saving strategies. At the end of 2013, a survey will be conducted to determine whether program recipients changed their energy consumption behavior and if they experienced the benefit of reduced energy bills and increased comfort.

Low-income households spend an average of 14% of their income on energy, compared to 3.5% for most other households. With the average utility bill of program recipients running close to $150 per month, simple weatherization measures can result in savings of up to $360 annually.

Through its leadership role with Clean Cities, the District is working closely with its numerous partners in the region to build awareness of weatherization opportunities that are available to the residents of the Sacramento Region. There have been a growing number of extreme heat events over the past decade, and low-income individuals are especially vulnerable. Residents, especially seniors, can benefit immediately by reducing their vulnerability to extreme-heat events.

Results achieved: The Home Energy Conservation Program has upgraded about 100 homes since its inception, achieving approximately one metric ton of GHG emissions reductions per home per year, at a cost of $300 per home. These GHG emissions reductions will increases with time at no additional cost.

Project name: Santa Barbara County's emPowerSBC program
Sector: Energy – Building Energy Efficiency
Approximate Date: Fall 2011-present

Project Description: EmPowerSBC helps homeowners countywide overcome obstacles to making energy saving improvements to their homes by making home upgrade projects easier and more affordable through incentives, financing, qualified contractors and expert energy advice. Homeowners can take advantage of high-dollar utility rebates and unsecured loans with low rates and flexible terms of loan repayment to allow for manageable monthly costs.

EmpowerSBC's eligible projects range from basic upgrades to more extensive additions of solar water heating and electric system upgrades. The basic upgrades include air sealing (filling holes, cracks and leaks), adding attic insulation, duct sealing, hot water pipe insulation and low-flow showerheads.

Web link:
http://www.empowersbc.org/home

Results achieved: In its first year and a half, emPowerSBC has contacted more than 3,000 homeowners and developed 350 leads for local contractors who have $1.7 million in retrofits going in 217 homes.

One participating homeowner was able to reduce their overall energy use by 52% as a result of home upgrades including whole house air sealing, R38 attic insulation, dual-paned windows, a high-efficiency furnace, and a tankless water heater. The homeowner received a $4,000 rebate from the statewide Energy Upgrade California program and a $500 federal tax credit. They financed the remaining project costs with a low-interest emPower Home Energy Upgrade Loan.

Project name: Sonoma County Energy Watch
Sector: Energy – Building Energy Efficiency
Approximate Date: 2009 ongoing

Project Description: Sonoma County Energy Watch (SCEW) is a local government partnership between the County of Sonoma and Pacific Gas and Electric Company (PG&E) designed to help save money and energy while reducing harmful impacts on the climate. It was established in January of 2009. SCEW provides energy efficiency services to local governments, nonprofit organizations, small businesses and special districts in the County of Sonoma who are PG&E customers. Services include free energy audits, energy efficiency consulting, incentives and rebates, and financial consultation.

- **Free Energy Audits -** SCEW, in partnership with The Energy Alliance Association, provides free, no-obligation lighting audits to determine opportunities for savings.
- **Incentives & Rebates -** SCEW offers rebates for direct install projects that are much higher than if customers were to approach PG&E directly. Core program rebates are also available for projects that reduce natural gas use. Building retrofit measures, including HVAC, boiler, chiller, and other improvements may also receive rebates.
- **Energy Efficiency Consulting -** SCEW will provide free technical consultation and best practices advice in the areas of energy efficiency and conservation.
- **Financial Consultation -** There are several zero and low interest loans available to help pay for energy efficiency projects. SCEW can assist customers in finding funding and financing for project implementation.

Results achieved: Since 2009 SCEW has disbursed over $1 million in incentives for over 170 individual projects that have saved roughly 5,236,968 kWh, 16,570 therms, and 1,265 metric tons of CO2 equivalent throughout the County—the equivalent of removing up to 211 cars from the road for a year. It also created an estimated 239 jobs.

Specific Example: YouthBuild Santa Rosa – Lewis School Retrofit. YouthBuild Santa Rosa, a program of Community Action Partnership of Sonoma County (a nonprofit organization) provides education, job skills training and leadership development for youth aged 16-24 who do not have a high school diploma. With partner John Muir Charter School, they assist youth in earning a high school diploma. SCEW worked with YouthBuild Santa Rosa on a lighting retrofit at the old Lewis School, which resulted in substantial energy and annual cost savings for the school. www.sonomacountyenergy.org

Project Shapshot
Total Project Cost: **$7,160**
Program Incentive: **$3,599**
Customer Cost: **$3,560**
Annual Savings: **$4,387***
Annual kWh Saved: up to 24,000
Avoided emissions: 5.43 MTCO2e
Payback period: **0.81 yrs**

*Annual savings based on roughly $0.18 per kWh

Project name: Sonoma County Comprehensive Energy Program
Sector: Energy – Building Energy Efficiency & Alternative Energy
Approximate Date: 2009 ongoing

Project Description: When the Sonoma County Board of Directors approved aggressive GHG reduction targets in 2006 (25% below 1990 levels by 2015), the Board directed County staff to develop a comprehensive strategy to: (1) reduce GHGs; (2) save money; and (3) replace worn-out equipment. The Department of General Services, with contract support, developed a comprehensive inventory of facility energy use and approximately 101 energy efficiency measures that met all three program objectives. Of these, the County selected 39 measures to implement at 24 County buildings. These included:

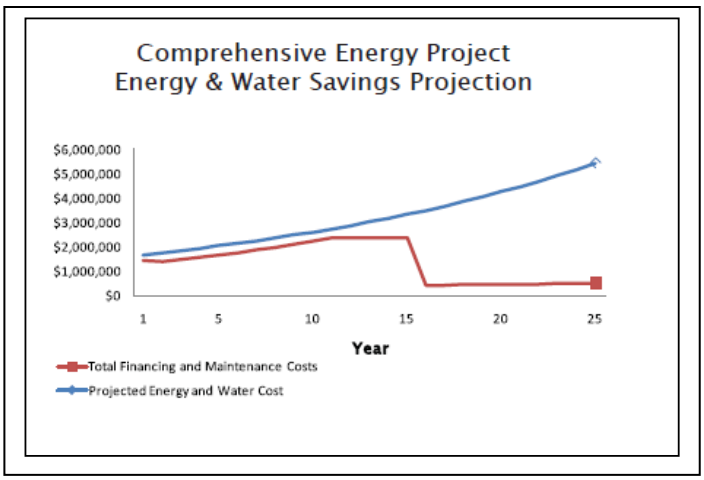
- Installation of 1.4 MW Fuel Cell Cogeneration Power Plant onsite
- Lighting retrofits at 20 buildings
- HVAC replacements or rebuilds in 4 buildings
- HVAC motors and variable frequency drives
- Water efficiency retrofits at 16 buildings
- Central Mechanical Plant upgrade (4 new chillers, 2 new boilers, and 1 new cooling tower)

Implementation of all measures was completed in 2010. Measurement and verification of the projects' performance continues.

Results:

Project Cost	
Financing Plan	$22,272,029
Incentives, Grants, and Rebates	$3,941,226
Financed Amount	$18,730,803
Estimated Interest Rate*	4.98%
Repayment Term	16 years
Assumed Closing/Funding Date	1/1/2009
Assumed Annual Energy Cost Escalation*	5%
First year of positivecash flow	Year 12
Total payments	$31,794,615
Total cumulative positive cash flow after25 years	**$38,404,231**

What	Savings by Unit	Cost Savings
Water	**16,500,000 gallons**	**$247,300**
Electricity	**2,262,445 kWh**	**$319,839**
Natural Gas	**171,164 therms**	**$121,500**
Fuel Cell	**10,830,193 kWh**	**$1,118,800**
Total Savings		**$1,807,439**



Web Link:
www.sonoma-county.org/gs/energy/pdf/CEP_Fact_Sheet.pdf

Project name: Sonoma County Regional Climate Protection Authority - Better Buildings Program: Sonoma Flex Package
Sector: Energy – Building Energy Efficiency
Approximate Date: 2009 ongoing

Project Description: In 2005 the ten local governments within Sonoma County set a mutual greenhouse gas target (25 percent below 1990 levels by 2015). The Regional Climate Protection Authority (RCPA) was created by the Legislature in 2009 to improve coordination on climate change issues and establish a clearinghouse for efforts to reduce GHG emissions. The RCPA is made up of representatives from each of the nine cities in Sonoma County and the Board of Supervisors. One of the key programs RCPA implements to reduce GHGs across the County is the Better Buildings Program, to work with homeowners, the business community, contractors, non-profits, and local governments to create the best approach toward achieving widespread energy retrofits. An essential element of the program will be creating local jobs by training contractors and others to provide retrofit services, from simple weatherization to “whole-house” retrofits.

The Better Buildings Program will:

- Create 16,300 local jobs
- Reduce GHG emissions by 168,000 tons CO2e
- Add an estimated $1.5 billion dollars to the Sonoma County economy

Through the Better Buildings Program, RCPA developed and implemented the Sonoma Flex Package, a retrofit incentive pilot program.

The Sonoma Flex Package was a retrofit incentive through which a homeowner could choose two or more measures from a menu to receive an incentive rebate of between $1,500 and $2,500 based on pre-determined energy savings. Flex Package was based on the Flex Path model innovated by the County of Los Angeles and was designed to:

- Test an alternative to the existing Energy Upgrade California Basic Path Rebate Program;
- Provide homeowners with limited budgets a home improvement pathway to Energy Upgrade participation;
- Offer contractors a streamlined job development and sales process; and,
- Deliver a minimum of 15 percent energy savings on average.

Results achieved: The Flex Pilot came to a close with the launch of the new Home Upgrade incentive. In roughly 10 months of availability, the Flex Pilot achieved the following:

- 24 complete projects
- $52,400 total rebates paid to local homeowners
- Estimated average project energy savings: 22.5% (of combined electricity and natural gas)

Project name: Sonoma County Regional Climate Protection Authority - Better Buildings Program: PAYS
Sector: Energy – Building Energy Efficiency
Approximate Date: 2009 ongoing

Project Description: In 2005 the ten local governments within Sonoma County set a mutual greenhouse gas target (25 percent below 1990 levels by 2015). The Regional Climate Protection Authority (RCPA) was created by the Legislature in 2009 to improve coordination on climate change issues and establish a clearinghouse for efforts to reduce GHG emissions. The RCPA is made up of representatives from each of the nine cities in Sonoma County and the Board of Supervisors. One of the key programs RCPA implements to reduce GHGs across the County is the Better Buildings Program, through which RCPA and the Town of Windsor piloted a Pay-As-You-Save (PAYS) program.

The RCPA worked with the Town of Windsor to design and implement a tariffed On-Water-Bill Repayment (OBR) pilot called Windsor Efficiency PAYS® (Pay As You Save). The OWB pilot set out to:

- Remove barriers to energy and water efficiency upgrades by creating a financing mechanism that is assigned to the meter location rather than the customer and a package of consumer assurances to eliminate all perceived risks associated with buying measures;
- Provide financing for energy and water upgrades that results in immediate positive cash flow on the customer's utility bill; and,
- Compliment local programs by financing upgrades that are not eligible for local property tax clean energy (PACE) financing offered through the Sonoma County Energy Independence Program (SCEIP). See example 6.

Results achieved: To date, PAYS has served approximately 5% of all residential units in Windsor, and achieved average savings of: (1) 10% of energy use; (2) 20% of indoor water use; and, (3) $15 per month in net utility costs. Based on initial program successes, the RCPA was authorized to expand the pilot through the Bay Area Regional Energy Network (BayREN). The BayREN PAYS Pilot continues to work with Windsor, as well as with the City of Hayward, the San Francisco Public Utilities Commission, and the East Bay Municipal District to explore how On-Water Bill Repayment can drive substantial resource savings.

Project name: GHG Reduction Protocol
Sector: Energy – Building Energy Efficiency
Approximate Date:

Project Description: The SCAQMD has a program to identify older boilers and process heaters that are not as energy efficient as newer models. Boilers and process heaters have a very long working life, and there are thousands currently in service in the South Coast Air Basin. This program focuses on making energy improvements or replacement of units at publicly owned facilities, such as educational facilities, government buildings and municipalities. This program is funded by a grant from US EPA to cover the cost of efficiency upgrades, or the cost of boiler/process heater replacement after the cost of the current rebate incentive is included with a focus on two environmental justice communities of Boyle Heights and San Bernardino. These efforts focus on achieving efficiency upgrades in the most cost effective manner. In order to quantify the benefits of this program, a protocol was developed by SCAQMD staff. Boiler efficiency protocol establishes a method to quantify reductions in GHG emissions and co-benefits resulting from an improvement in the efficiency of boilers and process heaters. Options to improve efficiency for existing boilers include an economizer or oxygen (O2) trim system. Co-benefit reductions (i.e., NOx, PM) would not generate credits, but could be used for CEQA mitigation. Boilers and process heaters under this protocol include those units used in medical facilities, educational institutions, office buildings, hotels, and industrial facilities.

Results achieved: Retrofits of two 40MMBtu/hr boilers are currently underway, and SCAQMD staff is actively seeking additional qualified candidates for retrofit or replacement of boilers or process heaters.

Project name: Regional Energy Efficiency Strategy
Sector: Energy – Building Energy Efficiency
Approximate Date: Since 2010

Project Description: The San Joaquin Valley APCD adopted its Regional Energy Efficiency Strategy that has established strong partnerships with energy agencies, municipalities, utilities, and other stakeholders around the Central Valley in order to inform and educate residents, businesses, and communities as to energy efficiency opportunities.

Results achieved:
As a part of these partnerships the San Joaquin Valley APCD administered the Energy Efficiency and Conservation Block Grant with 36 participating cities and counties reducing electricity consumption by 4.7 million kwh per year.

Energy

Alternative Energy

Project name: Monterey Bay Community Power
Sector: Energy - alternative
Approximate Date: Ongoing

Project Description: The Monterey Air District's APCO is the Vice Chair of the Board for the Monterey Bay Community Power Project, Project Development Advisory Committee. The project is investigating the option of community choice aggregation for the Monterey Bay region. The next step in the project is raising funds to conduct a technical feasibility study.

Project name: Community Environmental Council's Solarize Initiative
Sector: Energy - Alternative
Approximate Date: 2011 and 2012

Project Description: The Community Environmental Council (CEC)'s Solarize program leverages group purchasing and discounted pricing to help local homeowners install solar electric systems. CEC, at times working in partnership with other organizations, has implemented Solarize programs in a number of Central Coast regions including Santa Barbara, Ojai Valley, San Luis Obispo, and Santa Ynez Valley. To implement the program, CEC evaluates and selects experienced solar installation companies, and negotiates a limited time, discounted price that is then offered to local residents who utilize the program.

Web link:
http://www.cecsb.org/solarize-santa-barbara

Results achieved: CEC's Solarize programs have helped over 100 homeowners in the Central Coast region switch to solar powered homes. Case studies can be viewed on the CEC website.

Project name: UCSB/Santa Barbara County Multi-Jurisdictional Renewable Energy Task Force
Sector: Energy – Alternative
Approximate Date: January 2013 to present

Project Description: The Multi-jurisdictional Renewable Energy Taskforce emerged out of the 2nd Annual Central Coast Sustainability Summit, hosted by UCSB in October 2012, as a way for representatives from different agencies throughout the region to come together and work on renewable energy projects that would benefit Santa Barbara County. With the coordination of multi-jurisdictional partners, the taskforce has the ability to leverage a vast amount of knowledge and help renewable energy projects gain momentum and acceptance. A number of projects were brainstormed during the 2nd annual summit, and the taskforce provides a vehicle for representatives to continue meeting and further exploring the project ideas during the time in between summits.

Web link:
http://www.sustainability.ucsb.edu/multi-jurisdictional-renewable-energy-taskforce/

Results achieved: The taskforce has had three meetings so far, with a total of 19 different institutions from Santa Barbara County represented, including six cities, UCSB, the County Association of Governments, the Metropolitan Transit District, the Air Pollution Control District, Santa Barbara Unified School District, Community Environmental Council, Santa Ynez Band of Chumash Indians, and several other interested groups. Together, the taskforce members have chosen to focus on community choice aggregation (CCA) and joint renewable energy projects as potential initiatives on which they can collaborate for the benefit of Santa Barbara County.
Project name: Sonoma Clean Power – Community Choice Aggregation
Sector: Energy – Alternative Energy
Approximate Date: 2013 ongoing

Project Description: Sonoma Clean Power (SCP) is a new, locally controlled electricity provider in Sonoma County. It is a non-profit agency, independently run by the Sonoma County cities that have joined the program, including Sonoma, Santa Rosa, Cotati, Windsor and Sebastopol, and the County of Sonoma, which represents unincorporated communities. SCP provides residential and business customers across Sonoma County the option of using environmentally friendly power, generated by renewable sources, like solar, wind and geothermal, at competitive rates. Based on proposals for 2014 from potential energy providers, SCP electricity rates are expected to be:

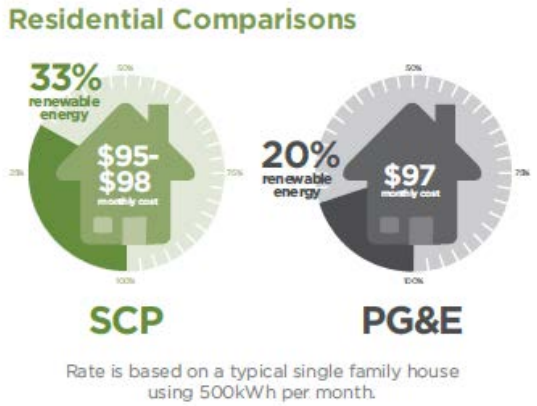
- Residential Rates: Estimated between 1.8% below and 1.1% above PG&E's rates.

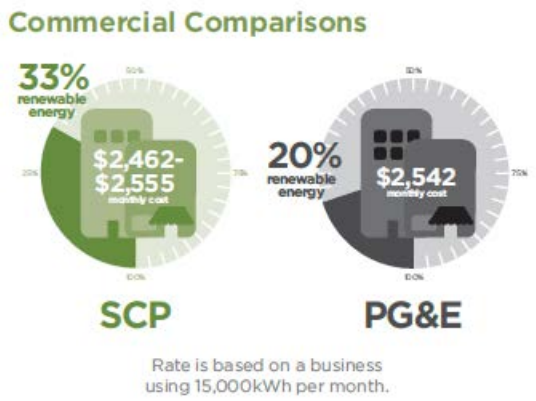
- Commercial Rates: Estimated between 3.1% below and 0.5% above PG&E's rates.

Actual rates will be available at least 60 days before service begins for the first group of customers. Service for the first of three phases begins in 2014. Later phases will be added in 2015.

SCP will supply greener power to homes and businesses. PG&E will continue to do all of the billing, deliver electricity and maintain the existing power lines. But SCP will receive 33% renewable energy in early program years, 50% renewable power in just a few years**.** SCP will also offer 100% renewable power for a small premium (likely to be about $10-$15 a month for a typical single-family house).

SCP will reduce the amount of greenhouse gas emissions associated with electricity use in Sonoma County by a minimum of 3.1 million tons over 20 years, the equivalent of planting 80,000,000 trees. In addition, SCP will reinvest its money in Sonoma County to develop local renewable power sources and support local jobs.





Web link:
www.sonomacleanpower.org

Project name: Sonoma County Energy Independence Program – Property Assessed Clean Energy Financing
Sector: Energy – Alternative Energy
Approximate Date: 2009 ongoing

Project Description: The Sonoma County Energy Independence Program (SCEIP) was initially formed when state legislation allowed local government to use local funds to provide up-front funding to eligible property owners to finance the installation of energy efficiency and water conservation improvements and renewable energy systems on their property. That program function continues as one of the many programs offered under the SCEIP umbrella; the original program is now known as the Property Assessed Clean Energy Financing (PACE) program under SCEIP.

Property Assessed Clean Energy Financing (PACE) is a financing option that authorizes a local government to provide up-front funding to eligible property owners to finance the installation of energy efficiency and water conservation improvements and renewable energy systems on their property. This funding is paid back to the County, with interest, over time on the owner's property tax bill. The financing is 100% voluntary. On March 24, 2009, the Board approved its participation in PACE financing, thereby launching the SCEIP. This Program established the first countywide PACE financing option in the State of California and continues to provide both residential and non-residential PACE financing.

Results achieved:

PACE Funding Summary since 2009		
	# of Applications	Funding
Applications Received	2,746	$99.5 million
Applications Approved	2,118	$69.8 million
Projects Funded	1,963	$64.0 million
Projects with funding pending	37	$1.1 million

PACE Project Summary since 2009	
Improvement projects completed by local contractors	2,526
Percent completed by local contractors	80 %
Jobs retained/created	511 local, 778 using the ARRA* formula
Solar installations completed	1,233
Annual Generation capacity of projects	8.9 MW

PACE GHG Reductions since 2009			
Residential solar PV	1156 systems	6.6MW	5751 CO2 e Tons/yr
Non-residential solar PV	46 systems	2.2MW	1896 CO2 e Tons/yr

Future Challenges and Alternatives: The SCEIP PACE program has two main challenges going forward: the position of the Federal Housing Finance Agency (FHFA) on PACE programs; and ongoing funding needs.

FHFA Position - The FHFA continues to hold that properties with energy assessments cannot participate in federal financing programs (Fannie Mae and Freddie Mac); the Ninth Circuit Court of Appeals dismissed the County's case, ruling that the Courts have no jurisdiction. This continues to prevent some property owners from participating in PACE. Action by Congress could address the problem.

Financing - The Sonoma County Treasury and the Sonoma County Water Agency together have authorized a maximum of $60 Million to be invested in SCEIP contractual assessment revenue bonds. Although early pay offs of some assessments coupled

with measured program growth allows for continued funding of new program participants, it is anticipated that interest and efforts to increase program participation will eventually lead to the $60M threshold being approached. Currently, $13 Million of this originally authorized $60 Million remains available for project funding. Possible options to address funding needs for this PACE program and programs in other jurisdictions include:

- Financing Marketplace: One area of opportunity being examined is collaboration and partnership with private PACE program providers. The PACE program initiative and funding landscape continues to expand driven by growing number of programs being implemented through private-public partnerships throughout the State. Such programs continue to evolve and they have one key common component - maximize the number of options provided to property owners to secure funding while utilizing underwriting criteria that safeguard the public entity's participation.
- PACE Bond Sale: The County Treasurer currently holds PACE bonds and is exploring the the release of a Request for Proposal (RFP) to determine whether there might be buyers for a portion of these bonds. As it relates to PACE, the financing market has seen a growing interest in investment portfolios linked to the provision of funds for energy conservation and renewable energy projects. This is contrary to the state of the market as recently as 12 months. This turn around in interest is driven by multiple factors with three key components being: 1) Pent up investment capital; 2) Recognition of the fiscal viability of such investments as construed under P.A.C.E type structures; and 3) The positive perception and value of investing in environmental sustainability efforts. Bonds sales may provide working capital for the program in the future.
- Forward Capacity Markets for Demand Reduction: Modest changes in the rules governing California's energy markets could allow public entities operating PACE programs to "bid" reductions in energy demand in the market place on the same basis that power producers bid energy production to meet forecast demand. The PACE program would be paid to deliver the promised demand reductions. The State of Vermont operates a such a market through the Independent System Operator (ISO) for New England, with the approval of the Federal Energy Regulatory Commission (FERC). Changes of this nature could be initiated by the California ISO, or by the Legislature, and would have to be approved by the FERC.

Information available at www.sonomacountyenergy.org

Project name: Sonoma County Regional Climate Protection Authority - RESCO
Sector: Energy – Alternative Energy and Building Energy Efficiency
Approximate Date: 2009 - 2012

Project Description: Sonoma County RCPA participated in a Renewable Energy Secure Communities (RESCO) project funded by the California Energy Commission. This collaborative project with the Sonoma County Water Agency, the Climate

Protection Campaign, and Los Alamos National Laboratory, created data analysis tools to show renewable energy potential and identify future projects.

Project elements:

- Design a renewable energy portfolio for the County that identifies opportunities for distributed generation and demand reduction
- Develop a system dynamics model of energy use and CO2 emissions across several County sectors
- Design and building a pilot project to showcase several renewable energy technologies to offset local demand
- Design County governance structures and financing instruments to implement the plan.

Project Outcomes**:**

- Suite of candidate projects that produces the lowest cost green energy for the County
- Proposal for a governance and financing structure to implement the system as a major public works project
- Computer model that describes greenhouse gas (GHG) impacts, costs, and jobs created
- Pilot project demonstrating RESCO principles: integrated, distributed, community-scale.

Results achieved: Research conducted through RESCO helped to inform the creation of Sonoma Clean Power, the third Community Choice Aggregation Program in the State (see item #5).

Project name: Energy Policy
Sector: Energy
Approximate Date: 2011

Project Description: The SCAQMD Air Quality Related Energy Policy was adopted by the SCAQMD Governing Board in September 2011 and integrates air quality, energy issues, and climate change in a coordinated and holistic manner. The Policy provides a list of actions needed to facilitate the implementation of zero and near-zero emission technologies.

Transportation

Alternative Fuel & Electric Vehicles

Project name: Bay Area Plug-in Electric Vehicle Ready Program
Sector: Transportation – vehicle projects
Approximate Date: 2011

Project Description: The Bay Area Air Quality Management District (Air District) developed the plug-in electric vehicle (PEV) program to support early PEV efforts and to provide incentives to the local consumer. This program began in 2011, continuing through 2012, with the Air District awarding over $3 million to incentivize the deployment of PEVs. Additionally, the Air District was awarded $800,000 in combined funding from the Department of Energy (DOE) and California Energy Commissions (CEC) to develop regional PEV Readiness Plans for the Bay Area and Monterey regions.

In June 2013, the Air District allocated an additional $6.25 million to support the deployment of electrical vehicles and electric vehicle charging infrastructure. Of that amount, $3.75 million is dedicated for incentive funding for Bay Area residential, business, and public agency fleets, and another $2.5 million towards funding PEV infrastructure at multi- dwelling units, workplaces, and public places. From the funds available for PEV infrastructure, $1 million was allocated for the DC Quick Charger Program to support the expansion of the Bay Area's publicly available network of chargers.

Results achieved: Hybrid and plug-in electric vehicles use electricity as their primary fuel or to improve the efficiency of conventional vehicle designs. This new generation of vehicles, often called electric drive vehicles, can be divided into three categories: hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and battery electric vehicles (BEVs). The Air District's PEV Program is expected to provide:

- Incentives for the installation of up to 2,750 Bay Area home chargers
- Incentives for the installation of 180 publicly available chargers
- Building public/private relationships with the local business community
- Enabling data collection to evaluate program effectiveness and inform future efforts
- Best practices for cities and counties with regard to building codes, permitting and inspection zoning parking and ordinances
- PEV Readiness implementation actions over the next 10 years for utilities, and local and regional governments

Project name: Plug-In Electric Vehicle Readiness Planning
Sector: Transp. – Vehicle projects (eg: alt./electric)
Approximate Date:

Project Description: The Monterey Air District is working with the Bay Area Air Quality Management District to implement a Monterey Bay regional plug-in electric vehicle (PEV) strategic plan for electric vehicle supply equipment (EVSE), establish best practices for "PEV-ready" building and public works guidelines, and to help streamline the EVSE permitting, installation, and inspection processes. The project is part of a larger project funded by the California Energy Commission.

As part of PEV readiness planning, the District participates in the Monterey Bay Plug-In Electric Vehicle Coordinating Council (PEVCC) and the Monterey Bay EV Alliance (MBEVA).

The District has also provided grant funds, through the AB2766 program, for the installation of charging stations and purchase of PEVs.

Results achieved: The following are the projects funded by the Air District with AB 2766 funds:

- 11 grant funded EV charge stations installed and operational in the region (8 more in the works)
- 1 grant funded EV

4 EV's added to the commercial rental fleet (Santa Cruz County) via grant funded PE

Project Name: EV Community Readiness Plan for the Central Coast Region of California
Sector: Transportation - Vehicle Projects
Approximate Date: 2012-2013

Project Description: SLO County APCD is working with Santa Barbara and Ventura County Air Districts, and the Community Environmental Council to develop an *EV Community Readiness Plan for the Central Coast of California*. This plan development is part of a statewide effort to streamline the permitting and installation process for electric vehicle infrastructure with the overall goal to facilitate and encourage mass adoption of Plug-in Electric Vehicles (PEVs) in the State of California. The plan recommends the adoption of policies, programs, and resources to develop "PEV-ready" infrastructure and "PEV-friendly policies" throughout the Central Coast region and assist the local jurisdictions in achieving their EV readiness goals. The Plan is targeted for completion in the 4th Quarter of 2013.

Results achieved: The Central Coast Region (Santa Barbara, Ventura, and San Luis Obispo Counties) was successful in securing $250,000 from the U.S. Department of Energy and the California Energy Commission to assist with development of the *EV Community Readiness Plan*. The Plan is targeted for completion by the end of the year.

Project Name: Alternative Fuel Community Readiness Planning for the Central Coast Region
Sector: Transportation - Vehicle Projects
Approximate Date: 2012-2013

Project Description: SLO County APCD is working with Air Districts and Clean City Coalitions statewide to adopt best practices and streamlining mechanisms to promote the use of lower carbon alternative fuels. The goal of this project is to advance alternative fuel markets by eliminating barriers to the deployment of alternative fuel vehicles and infrastructure at California workplaces and in California fleets. Nearly

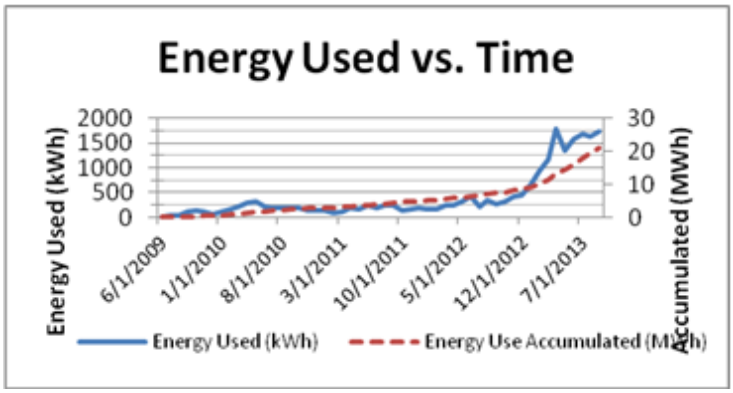
ninety six percent (96%) of all transportation energy that Californians consume comes from petroleum-based fuels and the state's transportation sector accounts for nearly forty percent (40%) of the state's greenhouse emissions.

Results achieved: The Central Coast Region successfully secured $35,000 to assist in the development of best practices as part of this statewide project.

Project name: Electric Vehicle Initiative – Infrastructure Project
Sector: Transportation – Vehicles (Charging Infrastructure)
Approximate Date: 2009 - 2013

Project Description: A coalition including the Northern Sonoma Air District, the Sonoma County Water Agency, the County of Sonoma, its nine cities, the Agriculture and Open Space District, and the Sonoma County Transportation Authority committed to develop the infrastructure to support electric vehicles and bring 1,000 of them into the County. As part of that effort, the District provided the local match that enabled Sonoma County to secure funding for a comprehensive network of electric vehicle charging stations, and continues to provide grants to public and private entities to fill out and expand this network. There are currently 60 active charging stations on this network. When the network is complete, the Sonoma County Electric Trail will include 116 charging stations, with stations in all of the County's cities as well as many other locations throughout the wine country and along the coast. It will provide access to charging that ensures a driver can take an electric vehicle anywhere in Sonoma County - and back again.

Results achieved: Over 20 MWh of cumulative charging at active stations, saving over 20 MT CO2e.



In addition to funding electric vehicle charging infrastructure, the District provides grants for alternative fueled, hybrid, and electric vehicles. In the last two funding cycles, funds have been provided for hybrid light duty vehicles, and diesel-hybrid medium and heavy duty vehicles.

Project name: Electric Vehicle Charging Infrastructure
Sector: Transp.- Vehicle projects (eg: alt./electric)
Approximate Date: 2011 to present

Project Description: The Santa Barbara County Air Pollution Control District (District) partnered with local agencies, businesses, and nonprofit organizations to raise awareness of the need for electric vehicle infrastructure, participating in outreach events and training workshops to educate the community about the technology and funding/incentive programs available.

Beginning in May 2011 the District developed an EV charging infrastructure program that provided funding for public entities to assist in the purchase and/or installation costs for Level II (quick-charge) or higher charging stations.

Under a grant from the California Energy Commission, the District partnered with neighboring districts San Luis Obispo County APCD and Ventura County APCD, and nongovernmental organizations to prepare an Electric Vehicle Infrastructure Readiness Plan for the California Central Coast region.

Web links:
http://www.sbcapcd.org/edu/clean-air-cars.htm
http://www.cecsb.org/pluginsb
http://www.c-5.org/

Results achieved: EV infrastructure grant agreements have been issued for EV charging stations in the City of Santa Barbara, at the University of California Santa Barbara, in the City of Buellton, and at Peabody Charter School in Santa Barbara. Other cities have expressed interest and the District currently has funds for additional EV infrastructure grants.

The EV Infrastructure Readiness Plan for the Central Coast region is currently in the final phase of development.

Project name: Sonoma County Green Fleet Program
Sector: Transportation – Vehicles (alt./elect)
Approximate Date: 2006 ongoing

Project Description: When the Sonoma County Board of Directors approved aggressive GHG reduction targets in 2006 (25% below 1990 levels by 2015), the Board directed County staff to reduce emissions from the County's On-Road fleet by 20% by 2010. In 2006 the fleet included 53 Hybrid Electric Vehicles. Starting in 2009, the County converted a Toyota Prius to a Plug-In Hybrid Electric Vehicle and subsequently converted eight more, and incorporated medium and heavy duty truck HEV's and PHEV's to the fleet. In 2011 the County purchased one of the first production models of the Nissan Leaf, and in 2012 Extended Range Electric Vehicles (EREV's) and factory PHEV's were added. The County currently has 264 hybrid electric and all electric vehicles, which comprise 29% of the entire Light Equipment fleet. A majority of the funds used to purchase electric hybrid and all electric vehicles have been supplied through the Vehicle Replacement Program that Fleet established and manages for County departments and external customers. The program is funded through a rate structure that charges customers a monthly fee for the future replacement of their vehicles. The differential cost between a conventionally powered vehicle and a hybrid electric or all electric vehicle was either supplied by grant funding or through the fiscal management of the Vehicle Replacement Program fund itself.

Results achieved: The Green Fleet Program has achieved a reduction of 2,925 tons of GHG, which is more than the 20% GHG reduction target. During the same period, overall fleet VMTs increased by over 10,000,000 miles as compared to the previous 10 year baseline. Currently the average fleet miles per gallon for the electric hybrid subsection of the fleet is 47.5 mpg as compared to 20.4 mpg for compared

The Sonoma County Fleet was recently recognized as number 14 in 100 Best Fleets in North America competition sponsored by Government Fleet Magazine, INVERS, and Property Room out of approximately 38,000 government fleets in North America. Though the recognition is based on the application and use of many public fleet best practices, the County's effort to pragmatically and holistically assimilate environmentally less impacting components into the public fleet was a critical element in the recognition process.

conventionally powered vehicles that they are replacing, which represents an average improvement of 27.1 mpg. The program has also saved over 137,000 gallons of gasoline. The fleet has driven over 8,677,000 miles in HEVs, PHEVs, Neighborhood Electric Vehicles (NEVs), and BEVs since 2002. Total life cycle costs for the County's first hybrid electric vehicles were less than the life cycles costs for the conventionally powered vehicles they supplanted (other same-time purchases) by $1,100 per vehicle.

Project name: Research, Development and Demonstration and Technology Deployment: Advanced Transportation Systems
Sector: Transportation – Alternative Fuel and Electric Vehicles
Approximate Date: 2012 and ongoing

Project Description: The SCAQMD has conducted numerous demonstration programs relevant to GHG emission reductions. In addition to programs demonstrating NOx and PM emission reductions from control of diesel-powered vehicles, SCAQMD has also conducted projects demonstrating zero-emission vehicles. The goods movement-related projects described below will all be conducted using Class 8 heavy-duty trucks. Examples of projects include:

(a) Demonstration of battery and neighborhood electric vehicles, which is co-funded by the South Bay Cities Council of Government (SBCCOG) and is a continuation of an existing project to demonstrate longer range battery electric vehicles.
(b) Siemens Mobility and Volvo Truck Catenary Truck Project, which involves infrastructure (catenary wires) being constructed along Alameda Street in the city of Carson for an approximate one mile segment. Two types of trucks are proposed to run on this system, including a battery electric truck, and a converted CNG-hybrid truck.
(c) DOE Zero Emission Container Transport Demonstration Project which involves four types of zero-emission drayage truck technologies installed in a total of 13 trucks during the first year of the project. This will be followed by two years of field demonstration in real world drayage operations with fleet partners.
(d) Volvo Plug-in Electric Vehicle Project which will employ a plug-in hybrid drive system, with the ability for fully zero-emission electric mode enabled for limited distances at low speeds. This plug-in hybrid powertrain will utilize a downsized diesel engine and is expected to improve fuel economy by approximately 30%.
(e) EVI/UPS Electric Vehicle Project. The EVI/UPS electric vehicle project uses 40 Class 6 medium duty trucks, specifically at UPS's San Bernardino facility.

Results achieved: The zero-emission vehicle projects will quantify the range, recharge time and energy efficiency for each utilization of zero-emission vehicles. These projects are ongoing and no results have been quantified yet. Prior work on the battery and neighborhood electric vehicle demonstration project has already shown that electric vehicles were used for an average of 26% of total commuter trips among the study

participants, and provided a 23% to 33% emission reduction. The EVI/UPS electric vehicle project has been completed, with delivery of all 40 trucks to UPS by June 2013.

Project name: Electric Vehicle Infrastructure
Sector: Transportation – Vehicle Infrastructure
Approximate Date: 2011 to present

Project Description: SCAQMD is involved in several plug-in electric vehicle (PEV) planning and deployment efforts. SCAQMD was the lead agency for the DOE funded California PEV Readiness Project which created six regional plans and a PEV readiness toolkit for best practices in PEV infrastructure planning. SCAQMD is in involved in several vehicle charging deployment efforts including the CEC funded SoCalEV Ready Program (installing 315 Level 2 chargers), CEC funded DC fast charging network (installing 20 DC fast chargers in Los Angeles and Orange Counties and incentives for 210 Level 2 chargers in the South Coast Air Basin). In addition to these, there is one DC fast charger and 20 Level 2 public chargers installed at SCAQMD headquarters. Additionally, SCAQMD is continuing its electric vehicle readiness efforts through the DOE funded California Fleets and Workplace Alternative Fuel Readiness Project, a statewide coalition led by BAAQMD.

Results achieved: Over 500 Level 2 chargers and 20 DC fast chargers installed.

Project name: Hydrogen Fuel Infrastructure
Sector: Transportation – Alternative Fuel and Electric Vehicles
Approximate Date:

Project Description: The SCAQMD has partnered with other companies and agencies to develop and install hydrogen technologies and infrastructure. Examples of these include: (a) developing hydrogen storage capability for a gas bending facility at the University of California, Irvine; (b) partnering with Hydrogenics Corporation to install a hydrogen generation and fueling station at SCAQMD Headquarters - this system uses electrolysis of water to produce hydrogen and includes the capability to produce backup electrical power using a hydrogen-powered internal combustion engine; (c) Partnering with UCLA to demonstrate a new hydrogen refueling station open 24 hours a day 7 days a week which will be accessible to the public; (d) partnering with Linde, LLC to expand the hydrogen fueling station infrastructure. Under this project, Linde will demonstrate that hydrogen fueling can be integrated with retail gasoline fueling and provide public hydrogen fueling to promote its viability in the marketplace. The station will be located in a heavily traveled area close to main corridors and adjacent to key residential areas (TBD).

Results achieved: The hydrogen fueling stations the SCAQMD is helping develop will provide the infrastructure needed to help implement greater usage of fuel cell vehicles.

Project name: Clean vehicle infrastructure/awareness
Sector: Transp. – Vehicle projects (e.g. alt/electric)

Approximate Date: Since 2012

Project Description: The San Joaquin Valley APCD received two grants, from the California Energy Commission and the Department of Energy, to increase zero-emission and clean vehicle awareness and deployment and looks to add much needed charging stations throughout the Central Valley region.

Transportation

Trip Reduction

Project name: BAAQMD Regional Bicycle Share Pilot Project
Sector: Transportation – Trip Reduction
Approximate Date: 2013

Project Description: Bay Area Bike Share Program is one of the first public bike share services offered in California and the first bike share program to launch as a regional, multi-city service in the country. Designed as a pilot program, bicycles are available at stations for use in San Francisco, Redwood City, Palo Alto, Mountain View, and San Jose. The Air District is the lead administrator and the program is being conducted in partnership with the City and County of San Francisco, the San Mateo County Transit District, the City of Redwood City, the County of San Mateo, and the Santa Clara Valley Transportation Authority. The program is membership-based for short-term bicycle rental. Members can check out a bicycle from a network of automated stations, ride to another station nearest their destination, and leave the bicycle safely locked for someone else to use. Prices are $88 per year for a full-time member or $22 for a three day pass and $9 per day for the casual rider. Stations are located near transit hubs, high-density residential areas and key destination points such as shopping or employment centers. The pilot period is anticipated to run for 12 to 24 months and the results will be used to assess opportunities for expanding the program into other Bay Area communities.

Results achieved: A main goal of the pilot program is to evaluate bike sharing's potential to reduce vehicle trips and improve local air quality. Bike sharing offers a clean and healthy alternative to single-occupancy vehicles, by providing a means for completing the first- and last-mile of trips in conjunction with regional transit, as well as stand-alone short distance trips.

Program Highlights Include:

- Approximately $11 million in public funds have been secured to implement the pilot system
- Planned expansion to 1,000 bicycles at 100 stations by 2014
- Enabling public access to bicycles 24 hours a day, 7 days a week
- Estimated regional demand to support fleet size up to 10,000 bicycles

Project name: Santa Barbara Car Free
Sector: Transportation/Miscellaneous
Approximate Date: 1998 to present

Project Description: The Santa Barbara Car Free project, founded and led since 1998 by the Santa Barbara County Air Pollution Control District is a collaborative effort to reduce air pollution and greenhouse gas emissions from tourists' cars. Amtrak®, the City of Santa Barbara, the Santa Barbara Region Chamber of Commerce, and Visit Santa Barbara, and more than 100 businesses, agencies, transportation providers, organizations, and local tourism businesses participate. The Project's 2013 "Cool Car Free Discounts" promotion features discounts from more than 66 hotels and activities, and a 20% discount on the Amtrak Pacific Surfliner®.

Web link:
http://www.santabarbaracarfree.org/

Results achieved: Thousands of visitors use the Santa Barbara Car free discounts every year to arrive in Santa Barbara by train, and/or to get around without a car once they arrive. The Project has received numerous awards, including a 2009 national Clean Air Excellence Award from the U.S. Environmental Protection Agency and the Clean Air Act Advisory Committee. Over the years, the Project has inspired similar efforts in other areas.

Project name: Sonoma County Transportation Authority & Sonoma County Climate Protection Campaign - WeGo Sonoma
Sector: Transportation – Building Energy Efficiency
Approximate Date: 2013 ongoing

Project Description: WeGo Sonoma is a real-time rideshare pilot program rolling out across Sonoma County. Using web and mobile technology, WeGo Sonoma provides a convenient and affordable way to share rides through a social network that connects riders and drivers in real-time and in advance.

The pilot aims to:

- Increase the number of shared commute trips while reducing the parking demand;
- Reduce greenhouse gas emissions; and
- Build a critical mass of users to continue ridesharing once local outreach wraps up.

The Sonoma County Transportation Authority is implementing the pilot in partnership with the Santa Rosa-based non-profit Climate Protection Campaign and their software provider, Carma.

A mobile phone is required to use the software. Those with smartphones can use the app either as riders or drivers. Those with basic mobile phones can use the software

only as riders. The software tracks shared trips and electronically transfers a micropayment from rider to driver to offset the cost of driving. To facilitate rideshare community-building, it also features a user rating system.

Additionally, those who live, work or learn (age 18+) in Sonoma County and participate in WeGo Sonoma are eligible for the WeGo MORE rewards and referral programs, with opportunities to earn fun rewards for sharing rides.

The Carma smartphone app for WeGo Sonoma is free to download. All new users receive $5 in credit to try the system as riders. Riders are charged $1 for the first mile of the shared trip then $0.20 per mile for the next 15 miles. Thereafter, the cost drops to $0.08 per mile. These micropayments from the rider to driver are transferred electronically. The driver also has the option of providing the rider a free ride in the app.

www.wegorideshare.com/**sonoma**

Project name: Employer Based Trip Reduction (eTRIP)
Sector: Transp. – Commute Trip Reduction
Approximate Date: Since 2009

Project Description: In 2009, the San Joaquin Valley APCD adopted a first-of-its-kind Rule (Rule 9410, Employer Based Trip Reduction), which requires larger employers to establish an Employer Trip Reduction Implementation Plan (eTRIP) to encourage employees to reduce single-occupancy vehicle trips, thus reducing criteria and GHG pollutant emissions associated with work commutes. The District has also offered a variety of incentive programs aimed at reducing trips, including its REMOVE program.

Water

Project name: Sonoma County Water Agency – Carbon Free Water by 2015
Sector: Water **(**Energy – Alternative Energy)
Approximate Date: 2006 ongoing

Project Description: Being the largest energy user in Sonoma County, in 2006, the Water Agency committed to the goal of operating a carbon free water system by 2015. To achieve this goal, the Water Agency is actively working to diversify its energy portfolio and reduce its energy and fuel needs through efficiency and renewable energy production. Through this effort, the Water Agency is helping to pioneer new technologies that have been carefully evaluated for economic viability. Efforts include energy and sustainability projects, programmatic efforts, and creative partnerships.

Some examples of the energy and sustainability projects currently under way include:

- Installation of a wind turbine at the wastewater treatment plant in Geyserville in January of 2013. The turbine will generate 5 kw at full capacity, cost $29,500, and supply 7% of the annual power consumption for that service zone.

- Energy efficiency improvements at the Water Agency's administration building, including: window film application, lighting retrofits, and LED installation. The window film saves energy by reducing the amount of heat transferred through the glass. This means that less energy is used to regulate the internal climate of the facility, because there is less of an external influence. The film application has a lifetime of 15 years and saves the Agency approximately 30,000 kWh annually. Almost half of the lighting retrofits were paid for through the Association of Bay Area Governments. The savings were achieved by pairing higher quality tubes with more efficient ballasts and eliminating unnecessary lights (aka delamping) in areas of low usage. More than 600 fixtures were retrofitted and provides the Agency approximately 62,000 kWh in annual savings. Each of the 16 LED tubes used to replace fluorescent tubes have lifetime of 50,000 hours, which last twice as long as the best fluorescent tubes in the market today. The Agency saves approximately 300 kWh annually, assuming 40 hours of weekly operation for 52 weeks.
- Installation of three photovoltaic systems that when combined generate 2 MW of solar electricity. The administration building has a 0.5 MW system that has panels flush on the roof and panels on a carport-like structure in the parking lot. The Airport Larkfield Wastewater Treatment Plant has a 0.5 MW fixed system that is ground mounted around the edge of one of the storage ponds. The Sonoma Valley Wastewater Treatment Plant has a 1.0 MW tracking system that is ground mounted in a field adjacent to a storage pond. The Agency continues to investigate additional opportunities for solar power generation.
- Evaluation and development of Community Choice Aggregation for local electricity. On March 22, 2011, the Sonoma County Water Agency Board of Directors directed the Water Agency to investigate Community Choice Aggregation (CCA) while concurrently approving the Water Agency's Energy Policy. Community Choice Aggregation allows one or more cities and/or counties to form a service area that provides for the purchase of power generation of customers within that service area. Water Agency staff undertook a comprehensive analysis of costs, benefits, and potential disbenefits. Based on the results of that work, staff developed and put in place the legal and policy foundation to create Sonoma Clean Power, which is now functioning as an independent endeavor (see example #5).
- Planned installation of a Farm-to-Fuels biodigester and 1.4 MW fuel cell. The biodigester would accept chicken manure from local egg producers and convert it to biogas and a nutrient rich fertilizer. A portion of the biogas would power the fuel cell, which would provide between 25% and 33% of the Water Agency's total base power needs; the remainder would be sold. The project is expected to reduce about 4,000 tons per year of GHGs, and also reduce runoff of chicken waste into the County's waterways. It involves a $55 million in direct capital investment, and will provide 36 permanent jobs, as well as 94 temporary construction jobs.

Select examples of programmatic efforts include:

- Establishment of Applied Solutions, a group of counties and cities across the country who are working to develop replicable, integrated, and sustainable community infrastructure projects. The non-profit has its own Board of Directors, and provides webinars, technical project guidebooks, and a library of economic assessments, as well as advice to its members. It is funded through grants; there is no fee to join.
- Creation of the Sonoma County Efficiency Financing (SCEF) Program, a program to finance energy efficiency and water conservation retrofits for public and non-profit facilities. The SCEF program is a scaled down version of a Sustainable Energy Utility (SEU) model. Under SCEF, participants can complete efficiency and conservation projects such as street and building lighting; HVACs, boilers and chillers; ducting, windows, partial roofing, and toilet replacements, among others. There are not upfront capital costs; all project costs are fully paid through a savings guarantee. Financing is customized for each participant and measure, tax exempt, and below market.
- Establishment, with the County of Sonoma, of the Sonoma County Energy Independence (SCEIP) Property Assessed Conservation Easement (PACE) program (see item #6).

The Water Agency also has creative partnerships with 37 other organizations, including cities, counties, federal, state, and local agencies, tribes, non-governmental organizations, businesses, universities, international organizations, and others.

Results achieved: As documented in the Water Agency's 2012 Greenhouse Gas Inventory Report for the Carbon Registry, the Water Agency has reduced its GHG emissions by 80% from 2007, which is four times greater than the reduction required to receive TCR's Platinum Member status, which the Agency received. These reductions include a 96% reduction in GHG emissions from electricity use alone. The Water Agency fully expects to reach its Carbon Free Water goal before 2015.
www.scwa.ca.gov/**carbon**-free-**water**

Project name: Santa Barbara County Green Business Program
Sector: Water Use; Solid Waste; Energy – Building Energy Efficiency;
Approximate Date: 2008 to present

Project Description: The Santa Barbara County Green Business Program is a free, voluntary program that offers incentives and assistance to encourage businesses to implement voluntary actions to protect, preserve, and improve the environment beyond what current laws require. Businesses meeting these criteria can be certified as green businesses. The program is a collaborative effort, with approximately 30 partner agencies, utilities and organizations that provide funding and in-kind labor for program operations.

Web links:
http://www.greenbizsbc.org/
http://www.sbcapcd.org/biz/greenbizsbc.htm

Results achieved: Since 2008, the program has certified over 70 businesses at a current rate of approximately 20 businesses a year. Certified business have reduced their environmental footprint in several resource areas by making strides in solid waste reduction and recycling, environmentally preferable purchasing, energy conservation, water conservation, and pollution prevention.

Through implementation of program checklist measures, like conducting audits, tracking usage, and adopting specific measures that reduce resource consumption, businesses have made noticeable reductions in costs related to water and energy use and waste disposal, translating into savings on their utility bills. Specific examples:

- A hotel in Santa Ynez Valley (certified in 2009) reduced their water use by 10.4% resulting in a water cost savings per room of 10.2%. The hotel also reduced electricity use by 6.9%, a cost savings per room of 10%. The hotel estimates that they are saving an average of $15,000 to $20,000 a year through a reduction in energy use, waste generation with trash pickups, water usage, copy paper reduction, etc.
- A real estate investment, development and property management company achieved certification for their corporate offices in Santa Barbara. The measures they implemented resulted in water cost savings of 41%, electricity cost savings of 25%, and they increased their waste diversion rate from 33% to 71%.

Solid Waste

Project name: Renewable Fuels and Clean Vehicles
Sector: Energy – alternative; Transp. – Vehicle projects; Solid Waste
Approximate Date: 2012-ongoing

Project Description: The Sacramento Metropolitan Air Quality Management District (SMAQMD) has a strong leadership role in partnering with regional organizations to achieve significant reductions in GHGs in the transportation sector, through supporting the use of alternative fuels, improved vehicle technologies, and smart, sustainable business practices. In particular, the SMAQMD is working with local organizations to convert organic wastes into renewable natural gas, thus reducing methane emissions from landfill as well as displacing conventional natural gas with a carbon-neutral alternative.

The SMAQMD is a founding member of Sacramento Clean Cities, one of the 90+ coalitions in the federal Department of Energy's Clean Cities Program, working to reduce GHG emissions from transportation, through efforts such as encouraging walking, cycling, and transit, and promoting the use of fuel-efficient vehicles and low-carbon fuels.

Sacramento Clean Cities places a strong emphasis on reducing Vehicle Miles Traveled (VMT) and promoting the regional production and use of renewable fuels. The SMAQMD is working with regional partners to encourage local processing and

consumption of foods grown in the region, and most importantly, turning that food waste into renewable natural gas through anaerobic digestion.

Processing and consuming locally grown food reduces "food miles" – the GHG emissions from food transport. Even more valuable for emissions reduction is turning biodegradable waste from food processors and consumers into renewable natural gas (RNG). RNG is carbon-neutral, is made from renewable fuel stock (organic waste), and can be compressed and used in existing natural gas vehicles without engine modifications. RNG can also generate electricity, and thus provide fuel for electric vehicles.

The SMAQMD, through its leadership role with Clean Cities, is working closely with numerous partners in the region to build awareness of the renewable fuel opportunities from the growing volume of organic waste. The District is working to expand the number of organizations and buildings that are separating their organic wastes and diverting it to a local anaerobic digester. Renewable natural gas is available today to the growing number of Sacramento fleets with natural gas vehicles. Through workshops, newsletters, public forums, and outreach opportunities, we hope to dramatically increase the volume of renewable fuel produced and used in the region. These efforts will play a significant role in the sustainability of the Sacramento region's economy, while achieving significant reductions in greenhouse gas emissions.

Results achieved: Currently, the Sacramento region is diverting 25 tons per day of food waste to an anaerobic digester, providing approximately 500 diesel gallons equivalent of compressed natural gas for 10 refuse trucks operating daily.

Project name: Waste-to-Energy (Alternative)
Sector: Energy - Waste
Approximate Date: ongoing

Project Description: The District has regulatory authority over a variety of waste to energy projects. The District works closely with project proponents to understand and comply with air quality regulations and obtain District approval, so that the GHG-reduction and alternative energy benefits are not out-weighed by increases in health-impacting pollutants, including oxides of nitrogen and air toxics.

Project name: Sonoma County Waste-to-Energy & Waste-to-Fuel
Sector: Waste
Approximate Date: Ongoing

Project Description: With nearly 24 million cubic yards of solid waste in place, the Central Disposal Site produces about 2,500 standard cubic feet/minute (scfm) of landfill gas. This gas is collected from 150 collection wells and transported through 4 miles of pipeline to the landfill gas-to-electricity facility and to the landfill gas-to-vehicle fuel pilot project.

The Landfill Gas Power Plant has a peak production over 7 mega-watts (MW) of renewable electrical energy 24 hours/day, seven days/week, enough to power a community of 17,000 people.

Up to 6 MW of the electrical energy is used by the Sonoma County Water Agency to help transport potable water throughout Sonoma County. Energy is also used for onsite power needs. The remaining energy is either used by the County jail (0.4 MW) or sold on the renewable energy market.

In addition to the Power Plant, a BioGas Filtration Plant (also called the compressed natural gas [CNG] plant) was completed in February 2009. CNG produced at the Central Disposal Site is currently used to fuel select vehicles in the Sonoma County Transit bus fleet. The plant uses membrane filtration to convert landfill gas to vehicle fuel where contaminants are removed via activated carbon and silica gel.

Gas production is currently below peak, for two primary reasons. First, successful diversion programs have diverted about 70% of the solid waste stream and reduced the per capita trash generated to 3.5 lbs per person, per day. Less solid waste means less landfill gas production. Select diversion programs include:

- Weekly curbside greenwaste pick-up, with material processed into compost for gardens;
- Re-use of lumber, posts, beams, and plywood, which are sold at about half the price of new material;
- Recycling of wood (unpainted lumber, pallets, plywood, wood chips, wood siding, and oriented strand board) into mulch;
- Free drop-off at “RecycleTown” for re-use and recycling of larger items, such as bicycles, furniture, and building materials, as well as toys, clothing, and textiles;
- House-hold hazardous waste drop-off site, business toxic waste drop-off site, community toxic waste collection, and the toxics Rover Pick-up program.

Second, between 2005 and 2010, no new waste was accepted at the landfill. The gap in landfilling also slowed production of landfill gas.

Additional information at: http://www.recyclenow.org/disposal/overview.asp.

Natural & Working Lands

Project name: Forest resource sustainability initiative
Sector: Natural & Working Lands - Forests & Biomass; Emissions - Inventory programs
Approximate Date: 2006 - Current

Project Description: The District is supporting sustainable forest management initiatives to restore the health of California's forest ecosystems and reduce the risk of catastrophic wildfire. Projects involve valuing the wide range of society and environmental benefits that are associated with treating forest fuels and the use of excess biomass for energy and production of biochar. These benefits include significantly improving regional air quality and reducing the risk of the California forests from becoming net emitter of GHGs -- and also protect watershed quality, soil productivity, wildlife habitat, recreational lands, forest resources, provide baseload power and economic support for rural communities, and reduce wildfire suppression costs. These projects directly contribute to the Scoping Plan objective to encourage sustainable activities that protect and maintain current forest stocks through reducing vegetative fuels that could feed wildfires and using this waste for biopower.
The District is leveraging resources and funds from our Clean Air Grant program and Supplemental Environmental Projects, with cooperation and coordination with forest land manager stakeholders including the USFS, CALFIRE, Sierra Nevada Conservancy, local Fire Districts, and industrial timber operators, and research institutions including UC Berkeley, UC Davis, and University of San Francisco.
Specific activities include:

- Demonstrating the significant air pollutant emissions benefits and economics from the utilization of excess biomass wastes for energy as an alternative to the standard disposal through open pile burning or mastication (chip and scatter).
- Developing a Biomass Waste for Energy GHG Offset Protocol.
- Establishing a methodology for, and quantify the, air pollutant benefits of forest hazardous fuels reduction projects that selectively remove small diameter trees and limbs and brush.
- Assisting the development of a regional network to economically collect biomass wastes for energy.
- Assessing the air pollutant emission benefits and economics of distributed forest biomass energy conversion systems in Placer County.
- Advocacy for, and active participation in, the development and implementation of energy pricing policy that values the full range of benefits of bioenergy and forest management while balancing ratepayer impacts.
- Technical support for the development of small scale distributed energy facilities throughout the Sierra Nevada's utilizing excess forest biomass as the feedstock and using best available control technologies.
- Developing of a Forest Biomass Waste Biochar GHG Offset Protocol.
- Quantifying and determining the impact of black carbon emissions from open pile burning.
- Advocacy for the investment of research and GHG funds toward further progressing sustainable forest management projects, particularly fuels reductions and bioenergy.
- Conducting research on quantifying the GHG benefits of reducing catastrophic wildfires as well as enhanced forest carbon sequestration opportunities to assist with the Scooping Plan target of maintaining current forest carbon sink.

Results achieved:

- Conduct of numerous projects in the foothills and mountains of the Sierra Nevada involving collection, process, and transport and utilize of excess forest biomass wastes for energy as an alternative to open pile burning. The use of over 20,000 bone dry tons of forest wastes has produced 20,000 MWh of renewable electricity, and reduced 7,000 tons of GHGs, 120 tons of PM, 32 tons NOx, 1,000 tons CO, and 100 tons NMOC. Emission benefits were published in the peer-reviewed Journal of the Air and Waste Management Association. For these efforts we were honored with a 2011 US EPA Clean Air Excellence Award.
- Developed a Biomass Waste for Energy GHG Offset Protocol that has been extensively peer-reviewed, and endorsed by the California Board of Forestry and CAPCOA GHG Exchange, to rigorously quantify the GHG reductions of biomass energy projects. We have conducted a number of projects under this protocol, and are in the process of having them verified and posted into the upcoming CAPCOA Exchange.
- Quantified the significant air pollutant reductions of forest hazardous fuel treatment projects. Determining they result from reducing wildfire size and severity and tree mortality, stimulating forest growth, producing wood products that sequester carbon and displace energy intensive alternatives, and using excess biomass wastes for energy to displace fossil fuels. We plan to refine and publish this work in the coming year.
- Participated as an intervener in the CPUC development and implementation of SB1122 and Feed in Tariff programs. These programs are intended to incubate and incentivize the investment in new strategically located distributed forest biomass energy operations; and will provide valuable baseload renewable electricity from woody biomass in regions that are at risk for catastrophic wildfire. Current efforts include streamlining interconnection, developing a power purchase template, establishing what qualifies as sustainable biomass, and ensuring equity to ratepayers.
- Provided multiple briefings on our forest resource sustainability initiatives in numerous workshops and conferences throughout the State and hosted several tours and forest field events in concert with UC Berkeley College of Natural Resources staff at their Blodgett Forest Research Station.

Placer County
AIR POLLUTION CONTROL DISTRICT

Vegetation

Project name: Urban Forest Air Quality Development Program
Sector: Vegetation – Urban Trees & open space
Approximate Date: 2008 - 2018

Project Description: The "Urban Forest Air Quality Development Program" is a targeted urban-forest management program to reduce the total emissions of biogenic volatile organic compounds (BVOC) from urban trees. Through a combination of community education and governmental policy change over several years, the strategy shifts to the planting of low BVOC-emitting trees rather than medium- and high-emitting trees. The measure calls for a modest number of low-emitting trees to be planted that otherwise would have been medium- or high-emitting trees. The Urban Forest Air Quality Development program was recently included as an emerging/voluntary control measure in the Sacramento Regional 8-hour Ozone Attainment and Reasonable Further Progress Plan.

Results achieved: Although no actual GHG emission reductions were quantified for this strategy, BVOCs increase the atmospheric lifespan of methane and ozone production, while the net impact of aerosol compounds on global warming is also uncertain.[1] There is potential for additional GHG reduction benefits to be realized though carbon sequestration, urban cooling, and decreased energy use.

Project name: Tree Planting
Sector: Vegetation – Urban Trees and Forest
Approximate Date: 2008 - Present

Project Description: The SCAQMD has implemented urban tree planting and reforestation projects to for the reduction of GHGs, clean air benefits, and help to provide employment opportunities. The SCAQMDs Tree Partnership program provided funds to help cities plant urban trees during the economic downturn while providing employment opportunities to students. Under this program over 9,000 California native low biogenic VOC trees were planted and over 500 students were employed. The SCAQMD is also funding an urban tree planting project with the LA Conservation Corps in the area surrounding the Chevron El Segundo refinery. Under this program the Urban Forestry protocol is being followed to identify the types of GHG reductions that be developed under this project protocol. Currently over a thousand trees have been planted by LA Conservation Corps. The SCAQMD is also funding a reforestation effort in the Station Fire burn area of the Angeles National Crest Forest for GHG reductions. Working with the US Forest Service and the National Forest Foundation over 400,000 seedlings have been planted.

Results achieved: Working with the US Forest Service and the National Forest Foundation over 400,000 seedlings have been planted.

Miscellaneous

Project Name: San Luis Obispo County APCD's Climate Change Program in San Luis Obispo County
Sector: Miscellaneous
Approximate Date: 2005 - present

[1] Peñuelas, J., T. Rutishauser, I. Filella. 2009. "Phenology Feedbacks on Climate Change." *Science* 324, p887-888.

Project Description: At the APCD Board meeting in May 2005, staff was directed to evaluate potential actions the District could take locally to address the issue of climate change. At its November 2005 Board meeting, action was taken to adopt a resolution acknowledging the significance of climate change and the importance of local actions to reduce its impacts and approve seven key strategies for staff to implement. The seven actions include: 1) Prepare a countywide inventory of greenhouse gas emissions, 2) Target a percentage of mitigation grant funds for greenhouse gas emission reductions, 3) Evaluate and quantify the GHG reduction benefits of existing district programs, 4) Develop public education and outreach campaigns on climate change, 5) Encourage and provide support for local governments; 6) Develop partnership with Cal Poly for addressing climate change, and 7) Join the California Climate Registry and encourage local industry participation. Since 2005, the SLO County APCD has been actively working on the actions identified above with primary emphasis on assisting local governments and implementing public outreach programs. Through the formation of the City/County GHG Stakeholder Committee that is comprised of all incorporated cities and county staff, the APCD continues to discuss State efforts regarding climate change (e.g., AB 32, ARB's Scoping Plan, and SB 375) and share issues that individual jurisdictions have encountered during the public discussion, inventory and climate action plan process.

Project Name: Stewardship Efforts
Sectors:
Energy - alternative
Energy - building energy efficiency
Transp.- Commute trip reduction
Transp.- Vehicle projects (eg: alt./electric)
Water Supply
Water Use
Approximate Date: June, 2011 – continuous

Project Description: The District has made significant improvements to the District's office building and operations which reduces negative impacts on the environment, and improves the health and comfort of building occupants, thereby improving building performance.

Specific activities include:

- Upgrade of District vehicle fleet mix with low emission vehicles
- Encouragement of carpool with flexible work schedules
- Teleconference capabilities
- Installation of a 29 kilowatt solar photovoltaic system
- Lighting fixture upgrades
- Control panel heating and cooling controls
- Upgrade of all Plug Load Occupancy units with motion sensor devices
- Installation of an advanced hybrid water heating system
- Attic and ceiling insulation upgraded from R19 to R39

- Upgrade of all HVAC units to highest available SEAR rating along with economizers and R8 ducting

Results achieved:

- Reduction of non-methane organic gases (NMOG) and nitrous oxides (NOx); toxic air pollutants including benzene, formaldehyde, acetaldehyde, and 1,3 butadiene; and Greenhouse Gases (CO2).
- Production of 46.1 Mw-hrs of renewable electrical energy which is the equivalent to 26.3 metric tons of CO2 from power plants.
- Reduction in energy loss by approximately two (2) percent, which is equivalent to consuming three (3) percent less energy

Project name: SCAQMD Regulation 27 – Climate Change
Sector: Miscellaneous
Approximate Date: 2008 to present

Project Description: The SCAQMD climate change rules create a voluntary Greenhouse Gas Reduction Program administered by SCAQMD. Under this voluntary program SCAQMD has approved GHG project protocols that can be used to generate GHG reductions. The GHG reduction projects can be undertaken by a third party that needs verification of the project or funds can be received by SCAQMD to undertake a project which then would result in retired GHG credits.

Final Recommendations
Environmental Justice Advisory Committee
on the Proposed AB 32 Scoping Plan
April 11, 2014

I. Introduction and Background

The Global Warming Solutions Act of 2006 (AB 32) required the Air Resources Board (ARB) to prepare a Climate Change Scoping Plan (Scoping Plan) to achieve reductions in greenhouse gas (GHG) emissions in California to 1990 levels by 2020. The Scoping Plan must be updated every five years and thus the ARB initiated this process in 2013. The ARB also reconvened the Environmental Justice Advisory Committee (EJAC) to advise the AB32 Scoping Plan Update (Update), with the goal of ensuring that environmental justice needs and concerns are integrated into the fabric of the State's climate programs.

California today is a majority people of color state, the ranks of which represent the strongest views on the environment and climate change. Voters of color were critical in saving AB 32 in 2010 when Prop 23 threatened to suspend our landmark climate law. Improved health and job outcomes were their aspirations for AB 32, and the EJAC echoes this belief in our recommendations. We see the promise of healthier communities when climate pollution is reduced and our families are part of the workforce that transitions us to a low carbon economy.

The EJAC's "Initial Recommendations to Inform Development of the 2013 Update to the AB 32 Scoping Plan" included specific GHG emission reduction strategies in each Scoping Plan sector, Cap-and-Trade, and currently uncapped sectors, plus an emphasis on short-lived climate pollutants. Our recommendations place great value on maximizing co-benefits (such as local pollution reduction, public health improvements, increased economic opportunities) and the need for ongoing assessment of the impacts of the State's climate programs on environmental justice communities. In the draft Update, we are encouraged to see mid and long-term GHG reduction targets, and progress in strategies to address short-lived climate pollutants, transportation, agriculture, waste, and natural and working lands. The EJAC identifies 5 priority changes to the Scoping Plan that include EJ metrics, accelerated AB 32 targets, problematic energy technologies, transit operations and weaknesses of the Cap-and-Trade program.

II. EJAC Recommendations: Progress, Outstanding Issues, Priority Changes

A. Overarching Issues

1. Progress:
   a) We are pleased to see the addition of short-lived climate pollutants (SLCP) to the list of economic sectors, including the regulation of fugitive methane emissions. We are encouraged to see our recommendation for an environmental justice assessment of AB 32 discussed in the Plan.

2. Outstanding Issues:
   a) While we agree with ARB on the need for strong metrics and new data collection tools, we are disappointed that ARB does not lay out a plan for developing an evaluation research agenda that addressed how CARB will evaluate the total potential costs and total potential economic and noneconomic benefits of the actions in the scoping plan.
   b) As evaluation and implementation of the Scoping Plan continues it will be important to ensure sufficient staffing at ARB, other implementing agencies, and the Climate Action Team. Addressing climate change and its social, economic and health consequences will require greater coordination and cooperation, new policy tools and more investments in solutions.
   c) Reversing climate change means shrinking our use of fossil fuels that when used release GHGs. It is important to address plans for increased conventional and unconventional fuel extraction in California, and how this practice will affect our ability to meet both clean air and climate goals in an era of proposed expansion.
   d) Nowhere in the Scoping Plan are green jobs discussed when one of the primary hopes of Californians in AB 32 is the jobs and economic opportunity that a green economy brings. Innovation in clean energy production and deployment have great economic promise but this promise will be lost if ARB and other state agencies do not make a coordinated effort to develop, train and deploy the new economy workforce. Define "green job" and prioritize low-income communities to benefit from AB32 programs and projects that yield green jobs. Existing and new job growth (in energy, natural lands, waste, transportation and other sectors) should provide family-sustaining wages, strong health and safety protections, and opportunities for training, education and career ladders to low-income communities.

3. Priority Changes:
   a) Assess the benefits and problems of AB32 in environmental justice communities so that as AB 32 is implemented, State Agencies can be responsive to and responsible for the communities hit first and worst by climate change. Collect, assemble and distribute the data on GHGs, criteria pollutants, air toxics, allowances and offsets

from over 800 reporting stationary sources by the end of 2014 and complete the analysis by June of 2015. Integrate the Adaptive Management Plan in these EJ metrics, and expand this program to include impacts from RPS and LCFS. This data along with facility locations needs to be shared with OEHHA, DPH, CEC and other agencies to explore options and determine the potential impacts on disadvantaged communities using many indicators and establish a baseline for future comparisons.

b) Set an aggressive and accelerated reduction curve beyond 2020 because of the critical importance of pursuing early reductions. California should establish 2030 (a minimum reduction of 40% of 1990 levels) and 2040 (a minimum reduction of 60% of 1990 levels) emissions reduction targets.

B. Energy

1. Progress:
   a) California's energy loading order is an important guide for the energy sector of AB 32, and has led to breakthroughs in energy efficiency and renewable technologies in the public and private arena. We agree that these technologies need to permeate the industrial sector where the greatest emissions occur. We are also pleased to see the nexus of energy and transportation, via the concentrated deployment of light, medium, and heavy vehicle electrification in our communities.

2. Outstanding Issues:
   a) It is counterproductive to AB 32 goals the plans to bring new high-emission natural gas power plants online, as well as expand fossil fuel extraction in our state lands. We know these industrial practices primarily harm environmental justice communities where they are sited, and accelerate climate change.
   b) The success of RPS and associated clean technology has provided economic benefits to companies and wealthier citizens across the state. To ensure that these public energy programs also reach low-income Californians, affirmative action to increase the siting of efficient and clean distributed energy projects in environmental justice neighborhoods is necessary (i.e. solar, wind, and energy storage projects).
   c) Robust workforce standards and career pipelines need to be developed proactively to ensure maximum GHG reduction, energy savings, and job creation. Green jobs should pay family supporting wages with good benefits and safety protections.

3. Priority Changes:
   a) California must reduce its energy use and transition to 100% renewable energy. Prevent new oil and gas operations (refineries, power plants) and unconventional fuels (fracking, tar sands, oil by rail, biomass incineration, waste to energy, artificially induced geothermal wells) from coming online because it adds GHGs and pollution rather than reduces them. Unanticipated consequences of currently deemed renewable energy under the RPS must be evaluated (life cycle emissions, co-

pollutants) by the CEC to ensure they do not create new problems in overburdened communities. The CEC should then render ineligible those technologies that increase air quality burdens. The CEC should ensure that imported renewable energy, including that from Tribal lands, is consistent with California requirements.

C. Transportation: Vehicles/Equipment, Sustainable Communities, Housing, Fuels, and Infrastructure

1. Progress:
   a) Good progress made on incorporation of the linkages between addressing climate change from the transportation sector while acknowledging the potential social justice impacts of Transit Oriented Development. Embedded in the scoping plan is also an recognition of the need to address SLCP and promoting a transition to cleaner freight alternatives.

2. Outstanding Issues:
   a) Provide guidance to transit agencies on the co-benefits of well-coordinated transit systems. Implementing agencies can and should incentivize the co-location of first/last-mile electric vehicle car sharing programs, safe routes with transit, etc. with increased incentives for income qualified core transit riders and rural farmworker communities.
   b) Preserving and investing in current transit services is as important to reducing VMT as is creating new ridership via expansion projects. Prioritization should be placed on the preservation of the existing transit systems (operations and maintenance/ replacement) rather than continued emphasis on expansion projects.
   c) Recommend that jobs/housing fit, and other racial and economic equity criteria for allocation of public monies targeted in support of equitable TOD planning, development, and supporting infrastructure be weighted heavily.
   d) Highway expansion and road repaving should not be considered eligible GHG mitigation strategies for purposes of the Cap-and-Trade investment plan.
   e) Public funding for infrastructure should be prioritized and focused to achieve the upfront benefits of more rapidly transitioning communities to transit based modes of transportation. Specifically, this would include strategically leveraging public resources among agencies and departments to equitable TOD that includes benefits to the existing core transit riders such as those residing in low income and affordable housing, and other investments near transit nodes that enhance mobility and affordability for our communities.
   f) Support and encourage efforts to strengthen AB32/SB375 mandates and incentives to ensure public benefits by ensuring strong equity focused TOD. Specifically, 1) remove barriers to and create resources for public land banking at the time of transit siting, 2) requiring or incentivizing meaningful anti-displacement measures and inclusion of affordable and low income housing, and 3) requiring a jobs-housing fit

analysis to be conducted concurrent with SCS preparation.

3. Priority Changes:

a) Financially support transit operations and restoration of transit service and routes in disadvantaged communities. The Plan should recognize and promote the GHG reduction and co-benefits of providing free youth transit passes for public school students and low cost transit service for low-income families.

D. Agriculture

1. Progress:
   a) Moving California agriculture toward sustainability remains a major challenge. In concept the Update agrees with EJAC on the need to address carbon and other GHGs from the agricultural sector. This includes measures to maximize carbon sequestration, reduce methane emissions and the phase out of organic materials at landfills and discusses expanding agricultural waste diversion through composting.

2. Outstanding Issues:
   a) CARB needs to move faster to set sector specific goals. Protecting agriculture will involve strong action that goes beyond discussing potential measures and face the challenge of creating more sustainable systems and practices
   b) Establish measures that limit the use of any crop for fuel and as a general principle, reduce overall transportation fuel use.
   c) Do not allow the creation of cap-and-trade offsets for methane capture from dairies..
   d) Directly regulate all major sources of agricultural GHG emissions.

E. Water

1. Progress:
   a) Energy and Water are inextricably linked and the scoping plan does address the need for greater conservation, communications and coordination.

2. Outstanding Issues:
   a) The state shall provide competitive grants and/or incentivize municipal governments to install water drinking fountains in appropriate areas of the community intended for pedestrians and bicyclists in the effort to further encourage non-vehicular transportation, i.e. sidewalks, greenways, and pedestrian refuges.
   b) While the scoping plan mentions several pieces of important water legislation there is no acknowledgment that the state of California also passed (AB 685) Water Code section 106.3. It states that it is the policy of the State that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."
   c) Hydro power should not be included in the Renewable Portfolio Standard for

pumping.

d) Decarbonize irrigation and systems to move water across the state by using distributed renewable energy to power these technologies.

F. Waste Management

1. Progress:
   a) The Proposed Update includes new recommended action to eliminate landfilling of organic materials at landfills, which is laudable.

2. Outstanding Issues:
   a) CARB should develop measures that do not have the unintended consequence of incentivizing new incinerators and "thermal technologies." The recommendations in their current format unfortunately continue to support greater investment in biomass incineration.
   b) Waste incinerators should have compliance obligations under the Cap-and-Trade program. The 2014 Proposed Update states: "ARB is to develop a comprehensive approach for the most appropriate treatment of the Waste Sector under the Cap-and-Trade Program." It appears that this "comprehensive approach" will determine whether incineration will be subject to future Cap-and-Trade compliance obligations.
   c) All definitions of what technologies constitute renewable energy should be consistent across state and local agencies. Please also see the above recommendations on waste to energy technologies.
   d) When ARB conducts this analysis, it should include a public process and meaningful engagement with environmental justice communities and others that will be impacted by the decision whether incinerators have compliance obligations under the Cap-and-Trade program.
   e) CARB should emphasize measures in the waste section that actually create real waste reduction like redesign of products and packaging, reuse, recycling and composting, instead of the current language that opens the door for increased incineration.
   f) ARB and other state agencies (including PUC, CEC, OEHHA, DTSC, and CalRecycle) should undertake a process to examine the growing evidence that biomass and biogenic carbon have real and significant climate impacts, examine long distance transport contribution to overall GHG impacts of burning biomass material, and examine assumptions health and environmental impacts from burning various materials considered to be biomass, including impacts of biomass ash. This is of growing importance as new EPA regulations allow for the increased burning of waste and biomass at industrial facilities (i.e. industrial boilers, cement kilns), and as material deemed to be biomass are exempt from compliance obligations under the Cap and Trade program.
   g) Eliminate organic materials from landfills, accompanied with elimination of organic materials from all incineration and thermal technologies in order to avoid creating new incentives for incineration/thermal technologies.
   h) During the analysis of whether incinerators are subject to future Cap-and-Trade compliance periods, ARB should commit in the Scoping Plan to a public process and

meaningful consultation with environmental justice communities who would be impacted by a continuing exemption for incinerators.

G. Natural and Working Lands

1. Progress:
   a) We see eye-to-eye on many of the goals in this sector, especially valuing the co-benefits of green infrastructure projects and targeted investments in disadvantaged communities.

2. Outstanding Issues:
   a) Natural and working land GHG reduction strategies, such as green infrastructure and ecosystems management, should be integrated into land use planning under Sustainable Communities Strategies and major transportation infrastructure projects.
   b) Community tree planting goals encourage proactive actions that have both localized and global climate benefits.

H. Short-Lived Climate Pollutants

1. Progress:
   a) Significant progress has been made in addressing the concerns and recommendations of the EJAC committee in regards to reducing the major short lived climate pollutants.

2. Outstanding Issues:
   a) The current recommendations call for primarily research and establishing inventories, and preliminary measures. While these are important first steps it is important to develop actual measures and tools to address agricultural emissions, emissions from concentrated animal feed operations.
   b) ARB needs to take seriously the need to reduce emissions from the agricultural sector and set specific measures now.

I. Green Buildings

1. Progress:
   a) The measures proposed in the green building sector do a good job of a addressing issues related to new buildings and the scoping plan acknowledges the need to increase the feasibility of micro grid and energy storage.

2. Outstanding Issues:
   a) AB 758 was passed in 2009 and yet no regulations have been developed.
   b) The plan should ensure that increased energy efficiency and building standards are being met without using toxic building materials that worsen indoor air quality and create an end of life disposal problem.

J. Cap-and-Trade Regulation

1. Progress:
   a) Through SB 535 (de Leon) and the Cap-and-Trade Investment Plan, we are aligned in targeting at least 25% of the investments for disadvantaged communities. We agree that measurements of GHG reductions and co-benefits are important to have in determining the success of AB 32's effectiveness.

2. Outstanding Issues:
   a) Strict and ongoing evaluation of the Cap-and-Trade system is important to determine the efficacy or weakness of the state's primary mechanism to reduce industrial emissions, because if it is not succeeding in achieving AB 32 goals, then the state needs to correct its course. Establish 2030 (a minimum reduction of 40% of 1990 levels) and 2040 (a minimum reduction of 60% of 1990 levels) emissions reduction targets.) and 2050 (a minimum reduction of 80% of 1990 levels) emissions reduction targets. Direct reductions of emissions should be prioritized in EJ areas.
   b) Minimize or eliminate carbon offsets, and international forestry offset programs such as REDD, since it can diminish direct industrial emissions reduction at fenceline communities and compromise GHG reductions in the state.
   c) Do not give away free allowances so as to avoid rewarding industry stalling, delay, and obstruction.
   d) The Adaptive Management Plan should provide for proactive solutions when unintended environmental justice impacts are discovered. Adaptive Management should be expanded to include the Renewable Portfolio Standard and the Low Carbon Fuel Standard. Publish annual report on where allowances are being surrendered and offsets used, disaggregated by facility, starting 2015.
   e) The controversial components of the cap and trade regulation (including offsets and free allowances), should not be exported to other jurisdictions.

3. Priority Changes:
   a) Reduce the weaknesses of the Cap-and-Trade program by selling all allowances, not extending transition assistance to the industrial sector with free allowances, canceling or disallowing the offsets program (especially REDD, methane capture from dairy digesters and coal mines, rice, forestry clearcutting) and not exporting this scheme to other jurisdictions.

III. Conclusion

The first EJAC asked some key questions on the Scoping Plan eight years ago that current EJAC members continue be concerned with. How do we maximize the public health, environmental and economic benefits of AB 32 for the communities who have borne a century of industrial pollution burdens and who are the most vulnerable to climate change impacts? We want to ensure that the Scoping Plan Update moves us quickly towards reducing emissions and diversifying our energy choices while at the same time being based in strong principles of equity and opportunity.

One of the aspirations of the EJAC and broader social justice movements is that AB 32 can set the stage for investments in a new green economy, creating new green career paths and entrepreneurial opportunities.

This scoping plan has a stronger focus on the short lived climate pollutants and greater acknowledgment of the need for deeper sector reductions. We hope that this refined vision will steer our course to 2020 and beyond and enable meaningful emissions reductions delivering a range of co-benefits and address the air pollution that represents a public health crisis in our communities. We continue to believe that AB 32 holds great promise for reducing the pollution that is fueling climate change and health inequalities, and ensuring that polluters pay for the harms they create.

Free allowances give polluters a way out of emissions reductions and provide their shareholders a windfall at the public's expense. Extending transition assistance for the industrial sector, and in particular the refining sector, does violence to the core principles of AB32. Offsets poses problems in verification of true carbon reduction, and then further threatens displacement of forest communities around the world that contribute to migration problems. The ARB should spend more of its effort to ensure the Adaptive Management Plan prevents and mitigates unintended consequences of the Cap-and-Trade program, especially in environmental justice communities. We want to see the benefits and opportunities of AB 32 focus on California. If California wants to export our climate programs to other jurisdictions, we have a responsibility to make sure it’s the meaningful programs like efficient and clean energy and investment in vulnerable communities, not controversial regulations that do nothing to reduce local emissions while transferring more burdens on low-income communities.

EJAC Recommendations - Priority Changes	Agency
1. Assess the benefits and problems of AB32 in environmental justice communities so that as AB 32 is implemented, State Agencies can be responsive to and responsible for the communities hit first and worst by climate change. Collect, assemble and distribute the data on GHGs, criteria pollutants, air toxics, allowances and offsets from over 800 reporting stationary sources by the end of 2014 and complete the analysis by June of 2015. Integrate the Adaptive Management Plan in these EJ metrics, and expand this program to include impacts from RPS and LCFS. This data along with facility locations needs to be shared with OEHHA, DPH, CEC and other agencies to explore options and determine the potential impacts on disadvantaged communities using many indicators and establish a baseline for future comparisons.	ARB, OEHHA, CalEPA, DPH
2. Set an aggressive and accelerated reduction curve beyond 2020 because of the critical importance of pursuing early reductions. California should establish 2030 (a minimum reduction of 40% of 1990 levels) and 2040 (a minimum reduction of 60% of 1990 levels) emissions reduction targets.	ARB
3. California must reduce its energy use and transition to 100% renewable energy. Prevent new oil and gas operations (refineries, power plants) and unconventional fuels (fracking, tar sands, oil by rail, biomass incineration, waste to energy, artificially induced geothermal wells) from coming online because it adds GHGs and pollution rather than reduces them. Unanticipated consequences of currently deemed renewable energy under the RPS must be evaluated (life cycle emissions, co-pollutants) by the CEC to ensure they do not create new problems in overburdened communities. The CEC should then render ineligible those technologies that increase air quality burdens. The CEC should ensure that imported renewable energy, including that from Tribal lands, is consistent with California requirements.	ARB, CPUC, CEC
4. Financially support transit operations and restoration of transit service and routes in disadvantaged communities. The Plan should recognize and promote the GHG reduction and co-benefits of providing free youth transit passes for public school students and low cost transit service for low-income families.	ARB, CalSTA
5. Reduce the weaknesses of the Cap-and-Trade program by selling all allowances, not extending transition assistance to the industrial sector with free allowances, canceling or disallowing the offsets program (especially REDD, methane capture from dairy digesters and coal mines, rice, forestry clearcutting) and not exporting this scheme to other jurisdictions.	ARB

APPENDIX F

Final Environmental Analysis

for the

First Update to the Climate Change Scoping Plan

Air Resources Board
1001 I Street
Sacramento, California, 95812

Date of Release: May 15, 2014

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PREFACE

A Draft Environmental Analysis (EA) for the Proposed First Update to the Climate Change Scoping Plan (Proposed Update) was released on March 14, 2014 for a 45-day public review and comment period that concluded on April 28, 2014. A total of 118 comment letters were received during the public comment period, seven (7) of which addressed the Draft EA.

California Air Resources Board (ARB) staff made minor modifications to the EA based on responses to comments and other updates. To facilitate identifying modifications to the document, modified text is presented with ~~strike-through~~ for deletions and <u>underline</u> for additions. None of the modifications to the Proposed Update alter any of the conclusions reached in the EA or provide new information of substantial importance relative to the EA. As a result, these minor revisions do not require recirculation of the document pursuant to the California Environmental Quality Act (CEQA) Guidelines, California Code of Regulations, title 14, section 15088.5, before consideration by the Board.

1.0 INTRODUCTION AND BACKGROUND

A. Background on 2008 Climate Change Scoping Plan

Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006 (AB 32, Statutes of 2006, Chapter 488) declares that global warming poses a serious threat to the economic well-being, public health, natural resources, and environment of California and charges the Air Resources Board (ARB) with "monitoring and regulating sources of emissions of greenhouse gases that cause global warming in order to reduce emissions of greenhouse gases." (Health & Saf. Code, § 38510.) AB 32 provided initial direction on creating a comprehensive multi-year program to limit California's greenhouse gas (GHG) emissions to 1990 levels by 2020 and initiate the transformations required to achieve the State's long-range climate objectives. One specific requirement of AB 32 is to prepare a "scoping plan" for achieving the maximum technologically feasible and cost-effective GHG emission reductions by 2020. (Health & Saf. Code, § 38561, subd. (a).)

The first AB 32 scoping plan (initial Scoping Plan), approved in 2008 and reapproved in 2011, contains a mix of recommended strategies that combine direct regulations, market-based approaches, voluntary measures, policies, and other emission-reduction programs calculated to meet the 2020 statewide GHG emission limit and initiate the transformations needed to achieve the State's long-range climate objectives.

B. Required Update

AB 32 requires ARB to update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions of GHG emissions at least once every five years. (Health & Saf. Code, § 38561, subd. (h).) The Proposed First Update to the Climate Change Scoping Plan (Proposed Update), released for public review on February 10, 2014, continues with the approach of the initial Scoping Plan by recommending a balanced mix of strategies to ensure that California remains on track to meet its long-term climate stabilization objectives. The Proposed Update highlights California's success to date in reducing GHG emissions and lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050, as required by AB 32, Executive Order S-3-05, and Governor Brown's Executive Order B-16-2012. The 2050 objective is consistent with an Intergovernmental Panel on Climate Change (IPCC)[1] analysis of the emissions trajectory that would stabilize atmospheric GHG concentrations at 450 parts per million carbon dioxide equivalent (CO_2e) and reduce the likelihood of catastrophic climate change.

[1] The IPCC is the leading international body for the scientific assessment of climate change established in 1988 under the auspices of the United Nations.

C. Environmental Review Process

1. ARB's Certified Regulatory Program under CEQA

ARB, as the lead agency for the Proposed Update, prepared this Draft Environmental Analysis (EA) in accordance with its certified regulatory program (Cal. Code Regs., tit. 17, §§ 60000 – 60008) to comply with the requirements of the California Environmental Quality Act (CEQA). (Pub. Resources Code, § 21000 et seq.) Public agencies with certified regulatory programs are exempt from certain requirements under CEQA, including but not limited to, preparing environmental impact reports, negative declarations, and initial studies. (Pub. Resources Code, § 21080.5; Cal. Code Regs., tit. 14, §15252.) The resource areas from the Environmental Checklist in Appendix G of the CEQA Guidelines were used as a framework for assessing the potential for significant impacts.

2. Supplemental Analysis

This EA supplements the environmental analysis prepared for the initial Scoping Plan in the *California Environmental Quality Act Functional Equivalent Document* (2008 FED) and *2011 Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document* (2011 Supplement) by assessing the potential for adverse and beneficial environmental impacts associated with the recommended actions identified in the Proposed Update that could be approved and become effective to further reduce GHG emissions. A brief summary of the prior environmental analyses is provided below:

a) 2008 Climate Change Scoping Plan Functional Equivalent Document

In 2008, ARB, acting as the CEQA lead agency under its certified regulatory program, prepared the 2008 FED that was included as Appendix J (Volume III) to the AB 32 Scoping Plan document. The 2008 FED analyzed the reasonably foreseeable indirect environmental impacts that could result from implementing the measures recommended in the initial Scoping Plan. The 2008 FED also included an analysis of a range of five alternatives to the initial Scoping Plan, including a "no project" alternative, a plan relying primarily on a Cap-and-Trade Regulation for the sectors included in a cap, a plan relying more on source-specific regulatory requirements with no cap-and-trade component, a plan relying on a carbon fee or tax, and a plan relying on variations of proposed strategies and measures. Following the public review and comment period, the initial Scoping Plan and the 2008 FED were considered by the Board at a public hearing in December 2008, and were subsequently finally approved by the Board's Executive Officer in May 2009.

Attachment 3 provides a summary of the impact analysis contained in the 2008 FED. Each recommended measure that involved regulatory action by ARB was subject to the required Administrative Procedures Act (APA) rulemaking process, which includes preparation of a Staff Report: Initial Statement of Reasons (ISOR) containing the required EA for that regulatory proposal. The ISORs and the Final Statement of

Reasons (FSORs) for individual rulemaking can be found on ARB's webpage at http://www.arb.ca.gov/regact/regact.htm.

b) 2011 Supplement to 2008 FED – Alternatives Analysis

In June 2011, in response to a decision by a California state trial court, ARB revisited and expanded the alternatives analysis provided in the 2008 FED. The 2011 Supplement provided an expanded analysis of the five project alternatives discussed in section V of the 2008 FED, and superseded and replaced the project alternatives section of the 2008 FED found at pages J-74 to J-90. Following a workshop and 45-day comment period, staff responded to comments received in a document entitled *Response to Comments on the Supplement to the AB 32 Scoping Plan Functional Equivalent Document*. At a public hearing in August 2011, the Board considered and certified the combination of the 2011 Supplement, the written response to comments, and the prior environmental documents, after which it reconfirmed the approval of the initial Scoping Plan. Subsequently, the trial court dismissed that portion of the lawsuit on the grounds that ARB had fully satisfied the court's requirements for an expanded alternatives analysis.

3. Programmatic Analysis

This EA, like the prior environmental documents it builds upon, contains a programmatic level of environmental review. (See Cal. Code Regs., tit. 14, § 15168 "Program EIR.") The level of detail in this EA reflects that the project is a broad plan; consequently, the analysis does not provide the level of detail that will be provided in subsequent environmental documents prepared for specific regulatory actions that ARB or other agencies decide to pursue to reduce GHG emissions. (Cal. Code Regs., tit. 14, § 15152.)

This EA provides a good-faith effort to evaluate the potential for significant adverse impacts associated with the reasonably foreseeable compliance responses that appear most likely to occur as a result of implementing the recommended actions identified in each of the nine sectors discussed in the Proposed Update. The EA contains as much information as is currently available without being speculative. The scope of analysis is intended to help focus public review and to inform the public that questions and comments are appropriate and meaningful.

While the types of foreseeable compliance responses can be reasonably predicted, the specific location, design, and setting of the actions cannot feasibly be known at this time, and therefore, this EA can address only broadly defined types of impacts, rather than any specific project or location, potential facility, or site-specific environmental characteristics. Therefore, the programmatic impact analysis applies generally across a broad geography, rather than any particular site or project-specific locations. If a later activity would have environmental effects that are not examined within this EA, the public agency with authority over the later activity would need to conduct additional environmental review, as necessary.

The impact discussion includes, where relevant, construction-related effects, operational effects of new or modified facilities, and influences of the recommended actions on GHG and air pollutant emissions. Because the specific location, extent, and design of potential new and/or modified facilities cannot be known at this time, the impact discussions reflect a conservative assessment to describe the type and magnitude of effects that may occur (i.e., conservative in that the conclusions tend to overstate adverse effects). These impact discussions are followed by the types of mitigation measures that could typically be required to reduce potentially significant environmental impacts. This EA takes a conservative approach in finding some impacts to be potentially significant after mitigation because the authority to determine project-level impacts and require project-level mitigation lies with the land use and/or permitting agency for individual projects, and because the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts. This conservative approach (i.e., tending to overstate environmental impacts) is intended to satisfy the good-faith, full-disclosure intent of CEQA.

It is expected that many of the impacts identified as potentially significant in this EA could be feasibly avoided or mitigated to a less-than-significant level during project-specific environmental review processes.

a) Beneficial Impacts

AB 32 establishes the objectives for GHG emission reduction activities in California. Section 38501(h) of AB 32 states:

> It is the intent of the Legislature that ARB design emission reduction measures to meet the Statewide emissions limits for GHGs established pursuant to this division in a manner that minimizes costs and maximizes benefits for California's economy, improves and modernizes California's energy infrastructure and maintains electric system reliability, maximizes additional environmental and economic co-benefits for California, and complements the State's efforts to improve air quality.

Although the primary focus of conventional CEQA impact assessment is identification and disclosure of adverse environmental impacts, California Code of Regulations, title 17, section 60005, subdivision (b) of ARB's certified regulatory program indicates:

> "All staff reports shall contain … an assessment of anticipated significant long or short term adverse and beneficial environmental impacts associated with the proposed action and a succinct analysis of those impacts."

Considering the legislative intent of AB 32, ARB's certified regulatory program, and the latitude under CEQA to recognize environmental co-benefits, this EA incorporates discussion of potential beneficial environmental impacts when those impacts are considered reasonably foreseeable and they are relevant to the decisions regarding the

Proposed Update. It is not possible to quantify these impacts because of the broad nature of this programmatic analysis. Potential beneficial impacts are described within the body of the text of the various impact sections.

4. Public Review Process for the EA

This Draft EA is being provided for a public review and comment period that starts on March 14, 2014 and ends on April 28, 2014. If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. A final version of this EA, along with staff's written responses to comments on the Draft EA, will be considered by the Board at a public hearing scheduled for May 22, 2014. The Board will also consider approval of the Proposed Update at that public hearing. If the Proposed Update is approved, a Notice of Decision will be posted on ARB's website and filed with the Secretary for Natural Resources. (Cal. Code Regs., tit. 17, § 60007, subd. (b).) The Notice of Decision will also be filed with the State Clearinghouse.

5. Organization of the EA

The EA is organized into the following chapters to assist the reader in obtaining information about the Proposed Update and its specific environmental issues.

- **Chapter 1, Introduction and Background,** provides a project overview and background information, and other introductory material.
- **Chapter 2, Project Description,** summarizes the recommended actions identified in the Proposed Update, the potential reasonably foreseeable compliance responses, and implementation assumptions.
- **Chapter 3, Environmental and Regulatory Setting,** contains the environmental setting and regulatory framework relevant to the environmental analysis of the Proposed Update.
- **Chapter 4, Impact Analysis and Mitigation,** identifies the potential environmental impacts associated with the recommended actions identified in the Proposed Update and mitigation measures for each resource impact area.
- **Chapter 5, Cumulative and Growth-Inducing Impacts**, provides an overview of cumulative effects of implementing the recommended actions against a backdrop of past, present, and reasonably foreseeable future projects.
- **Chapter 6, Mandatory Findings of Significance**, discusses whether the recommended actions have the potential to degrade the quality of the environment, substantive adverse impacts on human beings, and cumulatively considerable environmental impacts.
- **Chapter 7, Alternatives Analysis**, discusses a reasonable range of potentially feasible alternatives that could reduce or eliminate adverse environmental impacts associated with the recommended actions.
- **Chapter 8, References,** identifies sources of information used in this EA.

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2.0 PROJECT DESCRIPTION

A. Overview of the Proposed First Update and Scope of the "Project" under CEQA

Assembly Bill 32 (AB 32) requires the Air Resources Board (ARB) to update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions of GHG emissions at least once every five years. (Health & Saf. Code § 38561, subd. (h).) The Proposed First Update to the Climate Change Scoping Plan (Proposed Update) describes progress made to meet the near-term objectives of AB 32 and defines California's climate change priorities and activities for the next several years.

The Proposed Update builds upon the framework established by the initial Scoping Plan and provides recommendations for the State to achieve its long-term climate objectives beyond 2020. Under the guidance of the Climate Action Team, ARB and other State agencies collaborated during the development of the Proposed Update to identify and describe a long-term vision and near-term recommended actions to put California on the path to its 2050 emission reduction goals.

The recommended actions in the Proposed Update have been developed to reduce GHG emissions from key sources and activities, while improving public health, promoting a cleaner environment, preserving natural resources, and ensuring, to the extent feasible, that the impacts of the reductions are equitable and do not disproportionately affect low-income and minority communities. The recommended actions are designed to contribute to further GHG emission reductions by 2020 and to continue the State's progress toward meeting the long-term 2050 goal of reducing California's GHG emissions to 80 percent below 1990 levels.

For the purposes of this Environmental Analysis (EA), ARB considers the recommended actions in the Proposed Update to be the "project" under CEQA. CEQA defines a "project" as a discretionary action that has the potential to result in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment. (Cal. Code Regs., tit. 14, § 15378.) Here, reasonably foreseeable compliance responses associated with implementation of the Proposed Update's recommended actions have the potential to result in either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment.

B. Project Objectives

The primary objectives of the Proposed Update are listed below. These objectives are derived from the requirements of AB 32 (Health & Saf. Code, § 38561) and for the adoption of GHG emission reduction measures (Health & Saf. Code, § 38562).

1. To update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions at least once every five years (Health & Saf. Code, § 38561, subd. (h));

2. Pursue measures to maintain and continue reductions in emissions of GHG beyond 2020 (Health & Saf. Code, § 38551, subd. (b));

3. Pursue measures that implement reduction strategies covering the State's GHG emissions in furtherance of California's mandate to reduce GHG emissions to 1990 levels by 2020;

4. Reduce fossil fuel use – to reduce California's reliance on fossil fuels and diversify energy sources while maintaining electric system reliability;

5. Design an enforceable, amendable program – to design a program that is enforceable and that is capable of being monitored and verified;

6. Ensure emission reductions – to pursue emission reductions that are real, permanent, quantifiable, verifiable and enforceable;

7. Achieve technologically feasible and cost-effective reductions – to achieve the maximum technologically feasible and cost-effective reductions in GHG emissions, in furtherance of achieving the statewide GHG emissions limit (Health & Saf. Code, §38562, subd. (a) and (c));

8. Avoid disproportionate impacts – to ensure, to the extent feasible, that activities undertaken to comply with the measures do not disproportionately impact low income communities (Health & Saf. Code, §38562, subd. (b)(2));

9. Complement existing air standards – to ensure, to the extent feasible, that activities undertaken pursuant to the measures complement, and do not interfere with, efforts to achieve and maintain national and California Air Quality Attainment Standards (AAQS) and to reduce toxic air contaminant (TAC) emissions (Health & Saf. Code, §38562, subd. (b)(4));

10. Consider a broad range of public benefits – to consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health (Health & Saf. Code, §38562, subd. (b)(6));

11. Minimize administrative burden – to minimize, to the extent feasible, the administrative burden of implementing and complying with the measure (Health & Saf. Code, §38562, subd. (b)(7));

12. Weigh relative emissions – to consider, to the extent feasible, the contribution of each source or category of sources to statewide emissions of GHGs (Health Saf. Code §38562, subd. (b)(9));

13. Maximize co-benefits – to maximize, to the extent feasible, additional environmental and economic benefits for California, as appropriate (Health & Saf. Code, §38570, subd. (b)(3)); and

14. Avoid duplication – to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements (Health & Saf. Code, §§ 38501, subd. (g), 38561subd. (a)).

C. Description of Recommended Actions

The following section summarizes the recommended actions and the reasonably foreseeable compliance responses resulting from implementation of the recommended actions for each of the nine sectors discussed in the Proposed Update: energy, transportation, agriculture, water, waste management, natural and working lands, short-lived climate pollutants, green buildings, and the Cap-and-Trade Regulation. The focus is on those reasonably foreseeable compliance responses with potential to result in either a direct or reasonably foreseeable indirect physical change in the environment. Some compliance responses are actions that would not result in environmental effects (e.g., convening a research panel). Such recommended actions are noted and no environmental impacts are associated with their potential implementation. While the Proposed Update provides substantial information related to existing and past efforts, the EA focuses on recommended future actions.

1. Energy

a) Summary of Recommended Actions

The Proposed Update includes recommended actions to increase local energy generation and smart-grid technologies. To achieve this, ARB would work with other state agencies, including California Energy Commission (CEC) and California Public Utilities Commission (CPUC), to develop a program that could include: energy efficiency and demand response efforts, renewable energy development, power storage systems, smart-grid and microgrid deployment, and distribution and transmission system development and upgrades. Recommended actions for the Energy Sector are provided in Table 2-1.

Table 2-1 Key Recommended Actions for the Energy Sector
State agencies will develop comprehensive and enforceable GHG emission reduction requirements for the State's electric and energy utilities to achieve near-zero GHG emissions by 2050. Program development to be completed by end of 2016, and incorporate the following principles: • Thoroughly account for the carbon intensity and air quality impacts of various energy resources, generation technologies, and associated fuels. • Maximize local and regional benefits of energy facilities. • Minimize emissions of criteria air pollutants (CAPs) and toxic air pollutants (TACs).

Table 2-1 Key Recommended Actions for the Energy Sector
• Avoid disproportionate impacts to disadvantaged communities. • An enforceable program for all energy and electricity service providers. • Recordkeeping and reporting mechanisms to monitor and enforce the GHG emission reduction requirements. State's energy agencies pursue a series of key proceedings, including the following: • Develop criteria and rules for flexible demand response resources to participate in wholesale markets and integrate variable renewable resources, reducing the need for new flexible fossil generation. • Expand participation of regional balancing authorities in the California Independent System Operator (CAISO) Energy Imbalance Market and other potential methods of balancing authority cooperation, which provide low-cost, low-risk means of achieving real-time operational efficiency and flexibility needed for greater penetration of variable renewable resources, while ensuring support for GHG emission reduction programs. • Through the AB 758 process, CEC will develop a plan to encourage energy assessments—particularly when done at the time a building or unit is sold or by a predetermined date—as well as energy use disclosure requirements. • Enhance energy efficiency and demand response programs, <u>including development of education/outreach programs,</u> and develop robust methodologies to monitor and evaluate the effectiveness of these programs. Methodologies developed by end of 2015 with the enhanced program proceedings completed by end of 2016. • A CPUC proceeding to continue to streamline state jurisdictional interconnection processes to create a ministerial low-cost interconnection process for distributed generation completed by the end of 2015. The CEC to explore similar streamlined processes for interconnecting distributed generation in publicly owned utility systems. The CPUC and CEC consult as appropriate with the CAISO as part of these proceedings. • <u>ARB will assess existing barriers to expanding the installation of CHP systems and propose solutions (in consultation with the State's energy agencies) to achieve the Governor's objectives and that of the initial Scoping Plan for CHP to reduce GHG emissions.</u> ~~To achieve the goals of the initial Scoping Plan and the Governor's objectives for Combined Heat and Power (CHP) to reduce GHG emissions, ARB to consult with the State's energy agencies to assess existing barriers to expanding the installation of CHP systems and propose solutions that help achieve climate goals.~~ A future CHP measure could establish requirements for new or upgraded efficient CHP systems. • Evaluate the potential for carbon capture and sequestration (CCS) in the State to reduce emissions of CO_2 from energy and industrial sources. Working with the Division of Oil, Gas and Geothermal Resources (DOGGR), CEC and CPUC, ARB will consider a CCS quantification methodology for use in California by 2017.

b) Compliance Responses

Reasonably foreseeable compliance responses could range from small modifications to existing structures to utility-scale renewable energy projects. For instance, energy storage systems could be developed by modifying existing hydroelectric dams. Smart-grid technology includes installation of smart meters, which look similar to traditional energy meters and do not result in building modifications. Improvements to energy production, processing, storage, distribution, and transmission systems could be minimal, and consist of general housekeeping, vapor recovery valves, and frequent maintenance checks. In addition, to meet offset requirements, compliance responses may involve renewable energy project proposals. Renewable energy projects associated with these compliance actions could range from installation of solar panels and micro-turbines onto buildings (e.g., to create zero net energy [ZNE] buildings or CHP systems) to large-scale energy generation facilities, such as solar photovoltaic (PV) and wind turbine farms, and geothermal plants.

i) Energy Efficiency Programs

The Proposed Update includes the development of a comprehensive, enforceable GHG emission reduction requirement to reach near-zero GHG emissions for electric and energy utilities by 2050. Generally, the advanced energy efficiency applications and technologies include building design strategies and features that reduce demand-side loads, such as high-performance envelopes, air barrier systems, day-lighting, sun control and shading devices, careful selection of windows and glazing, passive solar heating, natural ventilation, and water conservation. Once the energy demand of buildings is reduced, loads could be managed with efficient equipment and systems.

The energy efficiency programs would be designed to maintain consistency with the State's broader energy policies, and include energy efficiency and demand-response efforts, renewable energy development, energy storage systems, smart-grid and microgrid deployment, and distribution and transmission system development and upgrades. Monitoring mechanisms would ensure reasonable progress is made in achieving mid-term and final GHG emission targets.

Reasonably foreseeable compliance responses that could be used to develop energy efficiency programs include: ZNE design standards for homes and businesses, demand-response programs, distributed renewable energy generation, CHP systems, energy storage technologies, smart grid and microgrid systems, and oil and gas production, processing, storage, distribution and transmission system upgrades.

ii) Zero-Net-Energy Homes and Businesses

ZNE generally refers to the design, construction, and operational practices that result in a building, or collective group of buildings, using no more energy over the course of a year than can be generated on-site through localized, distributed generating technology sources, such as solar panels, wind turbines, geothermal heat pumps, CHP systems, and fuel cells. This could be achieved by a combination of advanced energy efficiency applications and technologies to reduce overall energy demand, along with on-site, or nearby off-site in some cases, electricity generation to meet residual demand.

Combined with these advanced efficiency technologies, the remaining energy needs could be met using various on-site electricity generation technologies as noted above. Most ZNE buildings would still be connected to the electric utility grid, allowing for electricity procurement from traditional energy resources when on-site energy generation is not sufficient to meet a building's energy load. When on-site generation exceeds a building's energy requirements, surplus energy could be exported back to the utility grid with improvements in smart-grid technologies.

Reasonably foreseeable compliance responses could include changes to the design and construction specifications for new construction in California, or retrofits of existing buildings. This could potentially include increased demand, manufacturing, and production of more efficient heating, ventilation, and air conditioning (HVAC) systems, windows, doors, lighting, insulation, roofing, and other building materials and components, as well as on-site energy generating systems, such as solar panels, fuel cells, wind turbines, geothermal heat pumps, and other technologies. Increases in the installation, interconnection, operation and maintenance of such energy systems, either on-site or off-site, could potentially be required for all new construction. Design considerations for ZNE homes and buildings would be site specific, and could potentially require modifications to local building and zoning standards.

iii) Demand-Response

While developing demand-response as a renewable integration resource is a critical next step for the State, CPUC rulemaking also signals the importance of refining demand-response resources that cannot be bid into CAISO markets, but are beneficial to the State's goals of reducing energy consumption during peak hours. These resources, referred to as "load-modifying demand response," could reduce the State's demand curve over time through strategies, such as time-of-use rates and permanent load shifting programs. These programs could potentially reduce the need for gas-fired generation facilities in the future. Additionally, the rulemaking would explore how demand response could be better coupled with other demand-side resources, such as energy efficiency and distributed generation, so that retail customers see all their options and make well-informed decisions, thereby expanding demand-side resources collectively.

iv) Combined Heat and Power

CHP, also referred to as "cogeneration," generates on-site electricity and useful thermal energy simultaneously in a single, integrated system from a single fuel source, such as natural gas, biomass, and biogas). CHP systems may vary greatly in size, from less than 100 kilowatts (kW) to over 400 megawatts (MW) of generating capacity, and use a variety of operating technologies, including gas turbines, microturbines, reciprocating engines, fuel cells, and boilers. CHP technology is used in a wide variety of energy-intensive industries and facility types, including:

- **Industrial manufacturers** - chemical, refining, ethanol, pulp and paper, food processing, glass manufacturing
- **Institutions** - colleges and universities, hospitals, prisons, military bases

- **Commercial buildings** - hotels and casinos, airports, high-tech campuses, large office buildings, nursing homes
- **Municipal** - district energy systems, wastewater treatment facilities, K-12 schools
- **Residential** - multi-family housing, planned communities

Conventional power plants convert less than 50 percent of a fuel's energy to electricity with the balance lost as waste heat. By producing both electricity and usable heat, appropriately designed and sited CHP systems can convert as much as 90 percent of a fuel's energy into usable energy. Many industrial facilities require both electricity and thermal energy or heat for their operations. Facilities without CHP systems would typically purchase electricity from a centralized power plant and burn a separate fuel on-site to serve their thermal energy needs. Appropriately designed CHP systems could accomplish both of these needs more efficiently and cost-effectively, and reduce the need to develop new or expand existing power plants.

Reasonably foreseeable compliance responses could include increased construction and operation of new CHP facilities or retrofitting existing facilities with CHP systems. CHP facilities could range from smaller micro-scaled systems designed to serve smaller sites or buildings, to large facilities similar to a power plant designed for district-level or industrial applications.

v) Energy Storage

Energy storage technologies can provide an effective method of responding to daily fluctuations in demand. Energy produced at off-peak hours can be stored and used later to meet demand spikes, thereby reducing the need for fossil-fired reserve generation plants. Generally, four electricity storage technologies are considered to offer commercially viable options to meet potential demands: pumped hydroelectric, compressed air energy storage (CAES), batteries (NaS, Li-ion, Pb-acid), and flywheels.

These four types of electricity storage technologies could be reasonably foreseeable compliance responses. Pumped hydroelectric energy storage is a utility-scale technology, currently used at many locations world-wide. It employs off-peak electricity to pump water from a reservoir up to another reservoir at higher elevation. When electricity is needed, water is released from the upper reservoir through a hydroelectric turbine into the lower reservoir to generate electricity. A CAES system stores energy in the form of pressurized air, which is usually in underground caverns. Flywheel plants use electricity and convert electrical energy into kinetic energy with spinning discs, which can be sped up or slowed down to rapidly shift energy to or from the grid. Battery technologies are evolving and improving rapidly, leading to improved storage capacity and reduced cost. Currently, technologies under consideration include lithium-ion (Li-ion), sodium sulfur (NaS), and lead acid (Pb-acid) batteries.

Other technologies are under development and may become available in the near-future. These include superconductive magnetic energy storage, electrochemical capacitors, thermochemical energy storage, and hydrogen systems.

vi) Smart Grid and Microgrids

Smart-grid technology refers to computerizing the electric utility grid. It includes adding two-way digital communication technology to devices associated with the grid. Each device on the network can be given sensors to gather data (e.g., power meters, voltage sensors, fault detectors), plus two-way digital communication between the device in the field and the utility's network operations center. Smart grid allows for automation technology for which a utility can adjust and control each individual device or millions of devices from a central location.

Microgrids are autonomous electricity environments that operate within a larger utility grid. They can integrate power from small, distributed facilities, such as rooftop solar installations, into the grid.

vii) Oil and Gas Production, Processing, Storage, Distribution and Transmission System Upgrades

ARB could develop a regulation to control fugitive methane (CH_4) and carbon dioxide (CO_2) emissions from oil and gas production, processing, and storage tanks.

The reasonably foreseeable compliance responses that could occur under new regulations include the installation of vapor recovery equipment, implementation of best management practices related to general housekeeping (e.g., keeping storage tanks hatches closed), capture and return of gas to production lines, increased maintenance activities to replace leaking compressor seals and other components more frequently, and other potential recommendations to prevent fugitive GHG emissions. Most of these activities would occur within the footprints of existing oil and gas field operations. However, minor expansions of existing facility footprints could potentially occur as a result of a new regulation, depending on the range and site-specific application of recommendations employed to reduce emissions.

In addition, reasonably foreseeable compliance responses could include increased inspection and maintenance to reduce leaks at pipeline joints and fittings, and replacement of compression and metering stations pneumatic valves with no- or low-bleed valves. These activities would be anticipated to occur largely within the footprint of existing facilities, and in conjunction with regular inspection, maintenance or replacement of existing infrastructure. Any excavation or pipeline replacement that could occur would be similar to, or within the scope of, normal system maintenance or replacement activities.

viii) Carbon Capture and Sequestration

The Proposed Update includes a recommended action in the Energy Sector to develop a CCS quantification methodology by 2017. The Cap-and-Trade Regulation currently acknowledges the potential for GHG emission reductions from CCS, and states that covered entities may reduce their compliance obligations for each metric ton of CO2 that has been proven to be sequestered using a Board-approved CCS quantification methodology. Also, reasonably foreseeable compliance responses under LCFS could

include the deployment of CCS. A quantification methodology has not yet been adopted. (See also the Transportation and Cap-and-Trade Regulation sections in this chapter).

CCS is a process whereby CO_2 emissions are captured from large industrial sources, such as power plants, natural gas processing facilities, fertilizer plants, ethanol plants, and hydrogen plants, and are then transported and injected into underground geological formations, such as depleted oil and gas fields, or deep saline aquifers. The injection is designed to prevent the captured CO_2 from being released into the atmosphere. In some cases, enhanced oil recovery (EOR) has been proposed in conjunction with CCS projects in existing oil fields. EOR involves the injection of gaseous CO_2 into a formation to push additional oil to a production wellbore and, under the right conditions, improve oil viscosity and flow rate.

Reasonably foreseeable compliance responses associated with approval of the CCS quantification methodology could include the development and construction of CCS projects. These projects could include the modification of existing or new industrial facilities to capture CO_2 emissions, along with construction of new infrastructure such as pipelines, wells, and other surface facilities in various locations to enable the transport and injection of CO_2 into a geological formation for sequestration. The transport distances and pipeline construction requirements for the captured CO_2 would vary considerably, depending on the locations of specific industrial sources of the captured CO_2 and proposed underground formations.

2. Transportation: Vehicles/Equipment, Sustainable Communities, Housing, Fuels, and Infrastructure

a) Summary of Recommended Actions

The major types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero-emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement sustainable communities to reduce vehicular GHG emissions and provide more transportation options; and (4) improve the efficiency and throughput of existing transportation systems. Recommended actions for the Transportation Sector are provided in Table 2-2.

Table 2-2 Key Recommended Actions for the Transportation ~~Sector~~ System
Vehicle Technology • The 2017 mid-term review for Advanced Clean Cars, where ARB, U.S. Environmental Protection Agency (US EPA), and the National Highway Traffic Safety Administration (NHTSA) will conduct a technical assessment of vehicle technology trends, will inform future light-duty vehicle standards targeted at continuing to achieve GHG emission reductions of about 5 percent per year through at least 2030. • In 2016, ARB will propose rules and/or incentives, including the “Phase 2” heavy-duty vehicle GHG standards in conjunction with US EPA and NHTSA with a goal of achieving new vehicle GHG emission reductions of at least 5 percent per year.

Table 2-2 Key Recommended Actions for the Transportation ~~Sector~~ System

- For completion by 2017, ARB will engage the Office of Planning and Research (OPR) and other stakeholders to expand upon the 2013 Zero-Emission Vehicle (ZEV) Action Plan for medium- and heavy-duty ZEVs.

Fuels

- In 2014, ARB will propose enhancements to strengthen the Low Carbon Fuel Standard (LCFS). ARB will also consider extending the LCFS beyond 2020 with more aggressive long-term targets, such as a 15 to 20 percent reduction in average carbon intensity, below 2010 levels, by 2030.
- By 2018, the CPUC, CEC, California Department of Food and Agriculture (CDFA), and ARB will evaluate and adopt the necessary regulations and/or policies to further support commercial markets for low-carbon transportation fuels, including but not limited to:
    - Reducing off-peak demand charges for electricity and plug-in vehicle charging rates that strongly encourage off-peak charging both at home and at public chargers;
    - Development of large-scale renewable and low-carbon production facilities through continued funding for infrastructure;
    - Development and adoption of performance and quality standards;
    - Streamlined local permitting and siting for hydrogen fueling and charging infrastructure and utility interconnection for charging infrastructure; and Research.

Transportation, Land Use, and Housing

- In 2014, ARB will complete a technical review that will inform the need for and appropriate timing of revisions to the SB 375 regional targets established in 2010 for Sustainable Communities Strategies (SCS) being adopted and implemented by 18 Metropolitan Planning Organizations (MPO).
- The High-Speed Rail (HSR) Authority will work with other rail and mass transit providers to increase transit ridership both regionally and inter-regionally.
- The HSR Authority will continue construction of the HSR system, beginning with completion of all station-area planning by 2017 followed by completion of the initial operating segment in 2022. By 2029, HSR is scheduled to be completed between San Francisco and Los Angeles.
- ARB, the California Department of Transportation (Caltrans), the California Strategic Growth Council (SGC), and the California Department of Housing and Community Development (HCD), along with other State, local, and regional agencies, will coordinate planning and support to ensure that the expected GHG emission reductions from approved SCS are achieved or exceeded.

Sustainable Freight Strategy

- In 2014, ARB will complete the first phase of the Sustainable Freight Strategy, which will identify and prioritize actions through at least 2020 to move California towards a

Table 2-2 Key Recommended Actions for the Transportation ~~Sector~~ System

sustainable freight system. This strategy will be informed by technology assessments in all the major freight transport categories, including: trucks, trains, ocean-going vessels, commercial harbor craft, cargo-handling equipment, fuels, and air cargo/airports

Investments

- Leverage available public money to scale-up clean technology markets and strategies and ensure necessary infrastructure investments, including the following:
  - ARB, CEC, CPUC, and CDFA will support growing markets for clean passenger transportation, advanced-technology trucks and equipment, and low-carbon transportation fuels and energy, including any necessary infrastructure.
  - Caltrans, working with local and regional agencies, will consider lifecycle benefits and impacts (including environmental, construction, operation, and maintenance costs) for transportation infrastructure projects.
  - Caltrans and regional transportation agencies will increase investment in expanded transit and rail services, active transportation, and other vehicle miles traveled (VMT)-reduction strategies in their next regional transportation plans.
  - SGC will support SCS implementation, including, for example, integration of the regional transportation and Regional Housing Needs Allocation planning, as well as provision of local assistance for transit, active transportation, and affordable transit-oriented housing development; therefore, offering more efficient consumer choices.
- State agencies, including ARB and Caltrans, will incorporate into ongoing GHG planning efforts strategies that help achieve significant reductions in oxides of nitrogen (NO_X) by 2032 to meet the national ambient air quality standards (AAQS) for ozone. The 2016 State Implementation Plans (SIPs) will outline attainment strategies through 2032.

b) Compliance Responses

There are four main types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero-emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and develop communities that would minimize vehicular GHG emissions and provide more transportation options; and (4) improve the efficiency and throughput of existing transportation systems. These actions could result in the reasonably foreseeable compliance responses of an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or low- and zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards.

Infrastructure to support clean vehicles could be required, such as charging infrastructure and alternative fueling stations.

Additionally, when the development of a CCS quantification methodology is completed and approved, reasonably foreseeable compliance responses under the LCFS could include the deployment of CCS projects (see the Energy Sector section of this chapter for a detailed description of the recommended action and reasonably foreseeable compliance responses for CCS methodology development).

i) Vehicle Technology and Equipment

(a) Phase 2 Heavy-Duty Vehicle GHG Standards

The Proposed Update includes development of a measure that implements Phase 2 of the Heavy-Duty Vehicle GHG Emission Reduction Regulation. Phase 2 would establish more stringent GHG emission reduction requirements for medium- and heavy-duty vehicles and engines, and may include new national GHG emission reduction requirements for trailers. This measure would be developed in concert with the US EPA and NHTSA. Phase 2 of the regulation could be considered for approval by 2017.

Reasonably foreseeable compliance responses could include increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission heavy duty vehicle technologies including, but not limited to, standard hybrid vehicles, plug-in hybrid electric vehicles, battery-electric vehicles, fuel-cell vehicles, or other zero-emission vehicle technologies; and potential changes in the design and manufacturing of heavy duty trailers.

(b) Zero-Emission Vehicles

The initial Scoping Plan recommended the ZEV program. In September 2013, ARB released proposed amendments to the ZEV regulation that would adjust the optional Section 177 State compliance path provision, define how caps apply to a manufacturer's requirements, and disallows battery swapping to qualify under the fast refueling definition for Type IV and V ZEVs. The 2013 ZEV Action Plan was developed in response to Governor Brown's Executive Order (EO) B-16-2012 (March 23, 2012). EO B-16-2012 sets a long-term target of reaching 1.5 million ZEVs on California's roadways by 2025. The Proposed Update includes the development of actions that are designed to encourage the use of clean-vehicle technology. Reasonably foreseeable compliance responses could lead to an increase in the zero-emission vehicle market, and increase manufacturing of hydrogen fuel cells, plug-in hybrids, and battery-electric vehicles. New facilities may be required to meet the increased demand.

ii) Transportation, Land Use, and Housing

In compliance with Senate Bill (SB) 375, Statutes of 2008, each of California's MPOs must prepare and adopt an SCS as an integral part of its Regional Transportation Plan (RTP). The SCS contains land use, housing, and transportation strategies that would allow the region to meet GHG emission reduction targets established by ARB. Once adopted by the MPO, the RTP/SCS guides the transportation policies and investments

for the region and land use planning for cities and counties in the region. Generally, GHG reduction is achieved in an SCS through increased housing density, greater access to alternative forms of transportation, and mixed-use development with the goal of reducing VMT by cars and light trucks. ARB must review the adopted SCS andaccept or reject the MPO's determination that the SCS, if implemented, would achieve the regional GHG targets. The Proposed Update includes a review of the GHG reduction targets to evaluate the need to revise targets to continue to meet State goals.

iii) High Speed Rail System

The HSR system is part of the statewide strategy to provide more mobility choices and reduce GHG emissions. This Proposed Update supports the continued implementation of plans to construct and operate a HSR system between northern and southern California. As planned, the HSR is a 700-mile-long rail system capable of speeds in excess of 200 miles per hour on dedicated, fully grade separated tracks with state of the art safety, signaling and automated rail control systems.

The Proposed Update continues to support implementation of the HSR. The HSR Authority is planning to coordinate with other rail and mass transit providers to increase transit ridership both regionally and inter-regionally. HSR is scheduled to be completed from San Francisco to Los Angeles by 2029.

iv) Sustainable Freight Strategy

ARB is currently developing the first phase of the Sustainable Freight Strategy. This program is designed to comprehensively address the freight system and identify actionable next steps over a five- to seven-year period. This strategy would identify near-term actions resulting from technology and infrastructure assessments of each of the freight sectors, including principles and criteria for transportation infrastructure projects, and determine technology gaps, research needs, and necessary funding requirements. Reasonably foreseeable compliance responses could include increases in zero- and near-zero-emission trucks, zero-emission rail transport, and the use of cleaner fuels. In addition, recommendations could require that all containers transported between the marine port and the near-dock railyards use on-road, zero-emission vehicle technologies and/or fixed-guideway systems that do not create emissions from container transport.

Assessments would draw from technology expertise in the public and private sector and would lay the framework for identifying and prioritizing the next steps, including accessing and leveraging funding, near-term implementation strategies, and longer-term actions that could be included as measures in upcoming SIPs.

v) Investments

The Proposed Update includes advanced technology freight demonstration projects and pilot deployments of advanced heavy-duty vehicles and equipment in a variety of vocations. Reasonably foreseeable compliance responses could include: zero emission port trucks for near-dock rail pilot projects; pilot projects to deploy zero-emission and hybrid vehicles and equipment (e.g., charging stations) at distribution centers located in

areas most affected by air pollution; and development and demonstration of advanced technology locomotives, marine vessels, and cargo-handling equipment.

Investment throughout California in projects that modernize the passenger rail system and link seamlessly to local public transit systems could continue to build public transit ridership and shift travelers from single-occupancy vehicles to public transport. Rail modernization infrastructure investments would be coordinated with local and regional planning to be mutually supportive. As part of the early development of HSR, commuter, and urban rail systems are being upgraded and expanded to provide connectivity to the future HSR system.

Furthermore, ongoing investments could be distributed to local communities to plan and implement sustainable community development, including integrated public transit and HSR, Clean Vehicle Rebate Projects, Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, Zero-Emission Bus Transit Centers, and passenger and freight transportation infrastructure needs. Active transportation and public transit alternatives are increasingly in demand and are necessary to meet ongoing emission reduction targets. Caltrans, working with local and regional agencies, would coordinate local, State, and federal funding for transportation infrastructure (including construction, operation, and maintenance costs) and consider lifecycle benefits and impacts (including environmental, construction, operation, and maintenance costs) for transportation infrastructure projects.

3. Agriculture

a) Summary of Recommended Actions

The types of recommended actions for the Agriculture Sector involve GHG emission reduction and carbon sequestration opportunities. Due to limited research, and the wide variety of farm sizes, animals, and crops produced, there are few generally applicable, emission reduction or carbon sequestration strategies. Farm management practices could include: nitrogen management, such as the use of nitrification inhibitors or fertigation (i.e., application of nutrients through irrigation systems); CH_4 capture from manure; and soil management practices, including changing tilling practices or cropping patterns. In addition, precision irrigation; using the cleanest, most-efficient, and well-maintained equipment; and locally generated biofuels could reduce fuel use. In addition to management modifications on agricultural lands, local and regional land use planning could be used to incentivize conservation easements, urban growth boundaries, and maintenance of agricultural zoning. Other planning efforts may include recommendations from the Bioenergy Action Plan that addresses economic, infrastructure, and regulatory limitations associated with the use of digester biogas in natural gas pipelines and bioenergy-generated power in the electric grid. Recommended actions for the Agriculture Sector are provided in Table 2-3.

Table 2-3 Key Recommended Actions for the Agriculture Sector

- In 2014, convene an interagency workgroup that includes CDFA, ARB, CEC, CPUC, and other appropriate State and local agencies and agriculture stakeholders to:
  - Establish agriculture sector GHG emission reduction planning targets for the mid-term time frame and 2050.
  - Expand existing calculators and tools, to develop a California-specific agricultural GHG tool for agriculture facility operators to use to estimate GHG emissions and sequestration potential from all on-farm sources. The tool would include a suite of agricultural GHG emission reduction and carbon sequestration practices and would allow users to run different scenarios to determine the best approach for achieving on-farm reductions.
    - Make recommendations on strategies to reduce GHG emissions associated with the energy needed to deliver water used in agriculture based on the evaluation of existing reporting requirements and data.
- The Dairy Digester Workgroup will develop recommendations for a CH_4 capture standard by 2016.
- Conduct research that identifies and quantifies the GHG emission reduction benefits of highly efficient farming practices, and provide incentives for farmers and ranchers to employ those practices.
- By 2017, evaluate the data reported to the Regional Water Quality Control Board's (RWQCB's) Long Term Irrigated Lands Regulatory Programs to determine if the reported fertilizer data are adequate to establish a robust statewide GHG nitrous oxide (N_2O) inventory for fertilizer used in agriculture. If existing data are not adequate to develop an inventory, then develop a mechanism to collect the necessary data.
- In 2015, OPR, the California Natural Resources Agency (CNRA), the California Environmental Protection Agency (CalEPA), CDFA, and ARB will convene an inter-agency workgroup to engage local and regional land use planning agencies in establishing a coordinated local or State land use program to develop recommendations and targets for incorporating farmland conservation in local and regional land use planning.
- CDFA will strengthen technical assistance programs and associated financial incentives to help agricultural operators develop carbon plans and implement GHG emission reduction practices.
- In 2015, the Bioenergy Interagency Working Group will:
  - S~~s~~trengthen, refine, and implement actions contained in its Bioenergy Action Plan to promote the input of digester biogas into natural gas pipelines and bioenergy onto the electric grid.
  - Evaluate the potential biomass energy generation capacity.
  - Develop methods to quantify biomass life-cycle GHG flux.

b) Compliance Responses

Reasonably foreseeable compliance responses associated with the agriculture sector recommendations consist of nitrogen management, manure management, soil management practices, water and fuel technologies, and land use planning to enhance, protect, and conserve lands in California. These are described as follows.

i) Nitrogen Management

Nitrogen fertilizers applied to crops release N_2O, a significant source of agricultural GHG emissions. The current GHG emissions inventory lacks specificity and detail about the use of fertilizers in California agriculture. Obtaining more specific data on statewide fertilizer use in agriculture and nitrogen deposition on land would assist ARB with determining baseline emissions, thereby improving the GHG inventory. This information would also help guide the development of potential GHG emission reduction measures. Existing nitrogen tonnage reports and new reporting requirements under development by the RWQCB could be used to improve the existing GHG N_2O inventory for fertilizer. Further examination of these data would help determine if broader statewide fertilizer use reporting is needed.

Compliance Responses that could be employed include the use of nitrification inhibitors, fertigation (the application of fertilizer through irrigation systems), and other approaches. However, additional research is needed to evaluate the potential for GHG emission reductions.

ii) Manure Management

Livestock manure is a significant source of CH_4, and approximately half of the CH_4 generated from livestock comes from manure storage lagoons. Reasonably foreseeable compliance responses could include covering the lagoons and to allow for capture and use of CH_4 to produce energy or renewable fuel (e.g., with the use of a digester).

iii) Soil Management Practices

Historically, tilling (loosening and turning) of soil has been a fundamental agricultural practice to suppress weeds and loosen compacted clay soils. However, tillage releases large quantities of CO_2 and N_2O from the soil into the atmosphere. Compliance responses associated with soil management practices could include changing tillage methods and cropping patterns, which could also result in reduced fuel consumption by farm equipment, providing additional permanent reductions in GHG emissions, including short-lived climate pollutants.

iv) Water and Fuel Use

Compliance responses to reduce water and fuel use could include technologically advanced tools, such as remote irrigation systems, precision irrigation to crops, and using the cleanest, most-efficient, and well-maintained equipment for agricultural operations. In addition, fuels could be derived from plant matter (biofuels) and used onsite and at nearby production facilities, which could displace fossil fuel use.

v) Land Use Planning to Enhance, Protect, and Conserve Lands in California

Conservation of agricultural lands could be used to meet long-term climate goals. This could be accomplished through development of SCSs, including reducing VMT. Reasonably foreseeable compliance responses could include incentives for conservation easements, supporting urban growth boundaries, and maintaining agricultural zoning. In addition, local and regional land use planning actions and policies could more fully integrate and emphasize land conservation and avoided conversion of croplands, forests, rangelands, and wetlands, as well as expansion and promotion of urban forestry and green infrastructure.

4. Water

a) Summary of Recommended Actions

The Proposed Update includes three types of recommended actions to reduce water-related energy use: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less-energy intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes such as water rights applications. Recommended actions for the Water Sector are provided in Table 2-4.

Table 2-4 Key Recommended Actions for ~~the~~ Water Sector
Funding • California Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB) will give priority to funding integrated management plans that include robust existing or proposed water and energy conservation and efficiency and measures that achieve GHG emission reductions. Conservation programs ~~must~~ <u>should</u> include numeric targets. *Technology* • CEC will implement new water-related energy conservation measures and efficiency standards. • CPUC will complete water-energy nexus rulemaking by 2016 and to continue implementation of joint water-energy utility efficiency programs and partnerships • SWRCB and CPUC will incent resource-recovering wastewater treatment projects by 2015. • SWRCB and RWQCB by 2016 will implement green infrastructure permits to treat and capture urban runoff for local use. *Administration* • As directed by the California Water Action Plan, the DWR, the SWRCB, CPUC, CEC, CDFA, and ARB will guide adoption of GHG emission-reducing policies for water sector investments and action by 2015. Conservation measures and

Table 2-4 Key Recommended Actions for ~~the~~ Water Sector
regulations to reduce GHG emissions and maintain water supply reliability during drought periods will be a centerpiece of this administration action. • As directed by the California Water Action Plan, DWR, SWRCB, CPUC in consultation with the CDFA, will identify and incent implementation of rate structures that accurately reflect the economic, social, and environmental value of water in California while maintaining affordability for basic services. • As directed by the California Water Action Plan, SWRCB will develop a comprehensive groundwater management strategy, and the DWR and CDFA to provide technical and financial assistance to exceed SBx7-7 targets. • SWRCB and RWQCBs by 2016 will modify State and regional water board policies and permits to achieve conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. *Education* • As directed by the California Water Action Plan, DWR, SWRCB, CPUC, CEC, and CAISO will promote water-energy conservation outreach and education.

b) Compliance Responses

The Proposed Update includes actions from the California Water Action Plan, including conservation measures and regulations, incentivizing rate structures, and a groundwater management strategy. New policy development would require balancing multiple objectives (e.g., flood protection, sustainable food production, and renewable energy development). Coordination between multiple state agencies would be required to ensure that efficient and aligned policy objectives are met for applicable agencies, including: CEC, CDFA, CPUC, CAISO, SWRCB, and RWQCB.

Reasonably foreseeable compliance responses primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur.

5. Waste Management

a) Summary of Recommended Actions

Under the Proposed Update, programs would be developed to eliminate disposal of organic materials at landfills. Options could include: legislation, direct regulation, and inclusion of landfills in Cap-and-Trade. Infrastructure development would require identification of financing, funding, and incentive mechanisms, which may include Cap

and Trade Investment Plan; loan, grant, payment programs; LCFS pathways; CPUC (biogas from anaerobic digestion, Renewable Market Adjusting Tariff); and offset protocols for recycling, composting, and anaerobic digestion. The California Department of Resources, Recycling, and Recovery (CalRecycle) and Department of General Services (DGS) would take the lead in improving the State procurement of recycled-content materials through the State Agency Buy Recycled Campaign reform. Recommended improvements would need to be identified, and a plan developed, for implementing the identified improvements.

In addition, the Landfill Methane Regulation may be amended to include additional CH_4 controls at new and existing landfills, increases in the use of captured CH_4 for waste as a fuel source for stationary and mobile applications. Recommended actions for the Waste Management Sector are provided in Table 2-5.

Table 2-5 Key Recommended Actions for the Waste ~~Management~~ Sector
• ARB and CalRecycle will lead the development of program(s) to eliminate disposal of organic materials at landfills. Options to be evaluated will include: legislation, direct regulation, and inclusion of landfills in the Cap-and-Trade Regulation. If legislation requiring businesses that generate organic waste to arrange for recycling services is not enacted in 2014, then ARB, in concert with CalRecycle, will initiate regulatory action(s) to prohibit/phase out landfilling of organic materials with the goal of requiring initial compliance actions in 2016. • ARB and CalRecycle will identify and execute financing/funding/incentive mechanisms for in-State infrastructure development to support the Waste Management Sector goals. Mechanisms to be considered will include the Cap-and-Trade Investment Plan; loan, grant, and payment programs; LCFS pathways; CPUC proceedings (e.g. biogas from anaerobic digestion and Renewable Market Adjusting Tariff); and offset protocols. ~~for recycling, composting, anaerobic digestion, and biomass.~~ • ARB will lead a process of identifying and recommending actions to address cross-California agency and federal permitting and siting challenges associated with composting and anaerobic digestion. As the first step, ARB convened a working group in 2013 made up of representatives from CalRecycle, SWRCB, and local air districts to identify challenges and potential solutions. A working group report will be released in mid-2014. • ARB will explore and identify opportunities for additional CH_4 control at new and existing landfills, and increase the utilization of captured CH_4 for waste already in place as a fuel source for stationary and mobile applications. If determined appropriate, amend the Landfill Methane Regulation and/or move landfills into the Cap-and-Trade Regulation (2016/17). • ARB and CalRecycle will develop new emission reduction factors to estimate GHG emissions reduction potential for various recycling and remanufacturing strategies. To the extent that data are available, these factors will include upstream and downstream emissions impacts.

Table 2-5 Key Recommended Actions for the Waste ~~Management~~ Sector
• CalRecycle and DGS will need to take the lead in improving the State procurement of recycled-content materials through the State Agency Buy Recycled Campaign reform. Recommended improvements need to be identified by 2014, along with a plan for implementing the identified improvements.

b) Compliance Responses

Implementation of the recommended actions in the Waste Management sector would be reasonably expected to result in construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling, development of biomass facilities, and anaerobic digestion facilities. In addition, reasonably foreseeable compliance responses may include installation of CH_4 control devices at existing landfills. While some of these activities could occur within existing landfills, construction of new facilities may be necessary to accommodate increased demand of organic waste diversion.

i) Anaerobic Digestion

Anaerobic digestion is the biological decomposition of organic matter with little or no oxygen. The anaerobic digestion process occurs naturally in marshes and wetlands. There are a variety of controlled systems where anaerobic technology is currently used in the United States including wastewater treatment facilities and dairy manure digesters. In other countries (primarily Europe), anaerobic technology is used in municipal solid waste digesters to produce energy and to reduce the volume of solid waste that must be landfilled.

Anaerobic digester facilities that process solid waste produce biogas and digestate (liquids and solids). The biogas consists primarily of CH_4, which can be used for energy, and CO_2, with small amounts of hydrogen sulfide (H_2S), and ammonia (NH_3). Typically, biogas is saturated with water vapor and may have trace amounts of hydrogen (H_2), nitrogen (N_2), oxygen (O_2), dust and siloxanes. Residual products from anaerobic digestion are liquid and solid residuals (digestate) (CalRecyle 2010).

ii) Methane Control at Landfills

Landfill gas is produced naturally by the aerobic (with air) and anaerobic (without air) decomposition of organic waste in MSW landfills. MSW is compacted and buried and the buried wastes decompose over time. Because the waste is insulated from outside air, anaerobic decomposition produces large quantities of CH_4. In general, landfill operators are required to provide a daily cover of soil or other approved material over the waste that is received by the landfill to prevent odors and other nuisances.

Landfill gas typically consists of CH_4 and CO_2, with trace levels of non-methane organic compounds (NMOC). NMOCs include volatile organic compounds (VOC), toxic air contaminants (TACs), and odorous compounds.

CH_4 emissions from MSW landfills are controlled by first containing the gas by using soil, compacted clay, geomembrane, biocovers, or other surface covers, and then capturing the gas through the installation and operation of gas collection and control systems. These systems consist most commonly of vertical wells and in some cases horizontal trenches that are buried within the waste and connected to header pipes which route the gas to a pump or blower station. Vacuum applied to the wells by a pump or blower draws the gas to a control device (e.g., flare, internal combustion engine, boiler, gas turbine, or microturbine). The collected gas can either be combusted, used to produce energy, or purified for offsite use (ARB 2009).

6. Natural and Working Lands

a) Summary of Recommended Actions

The Proposed Update includes addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts would be aimed at urban, natural and working lands, and agricultural croplands within and across jurisdictions, which all should be considered to create interconnected land areas and ecosystems. Recommended actions for the Natural and Working Lands Sector are provided in Table 2-6.

Table 2-6 Key Recommended Actions for ~~the~~ Natural and Working Lands ~~Sector~~
• The California Natural Resources Agency (CNRA) and CalEPA will convene an inter-agency forest climate workgroup to prepare and publish a "Forest Carbon Plan" in 2016. The Forest Carbon Plan will: o Set quantitative near-term, mid-term and long-term planning targets to ensure an increase in net forest carbon storage in California commensurate with the State's long-term GHG reduction goals, and in light of recent research that suggest that forests in California may be a source of GHG emissions rather than a carbon sink. o Identify near-term and long-term actions necessary to meet quantitative planning targets while ensuring forest resilience and health, ecosystem services, conservation of the forest land base, and continued economic opportunities. o Evaluate GHG emission and carbon sequestration trends for different forest land ownership types and consider sector sub-targets for each type. o Develop specific recommendations regarding approaches for funding actions to ensure that forests in California provide net long-term carbon storage. • In 2016, through AB 1504, the California Department of Forestry and Fire Protection (CalFIRE) and the Board of Forestry and Fire Protection (BOF) will evaluate methods to develop a life cycle analysis to track carbon in wood products; this work should be coordinated with ARB's forest inventory and support the Forest Carbon Plan. • The Bioenergy Interagency Working Group will continue to work with stakeholders and relevant agencies to:

Table 2-6 Key Recommended Actions for ~~the~~ Natural and Working Lands ~~Sector~~
o S~~s~~trengthen, refine, and implement actions contained in its Bioenergy Action Plan related to use of forest biomass. o Evaluate the potential biomass energy generation capacity. o Develop methods to quantify biomass life-cycle GHG flux. • In 2015, OPR, CNRA, CalEPA, CDFA, CDFW (California Department of Fish and Wildlife), CAL FIRE, and ARB will convene an inter-agency workgroup to engage local and regional land use planning agencies in establishing a coordinated local land use program. The program will set planning targets that identify, prioritize, and incentivize land conservation; increase urban forest canopy cover; bolster development of green infrastructure; and limit the conversion of both agricultural croplands and natural and working lands. • In 2015, CNRA, CalEPA, CDFA, CDFW, CAL FIRE, and ARB will convene a natural and working lands climate investment working group to draft a report outlining funding needs, opportunities, and priorities for the natural and working lands sector. • Expand urban forestry and green infrastructure programs and investments, particularly in California's environmental justice communities. • Continue to analyze the UC Berkeley research methodology and data to develop GHG inventory updates, incorporate more recent data into the newly developed tools for carbon quantification, and invest in and expand monitoring and research to reduce uncertainty ~~fill data gaps~~ in ~~California's inventory, particularly with respect to~~ carbon quantification ~~stocks~~ and attribution of GHG flux ~~in rangelands and wetlands. Forest inventory data also require refinement and may include research on forest soil carbon~~ by disturbance process.

b) Compliance Responses

Reasonably foreseeable compliance responses would involve coordination between state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally aim to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (e.g., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. This could be accomplished through increased use of biomass facilities.

i) Forest Carbon Plan

The Forest Carbon Plan would include mid-term and long-term planning targets; identify actions to meet those targets; and provide recommendations on funding those actions. The Forest Carbon Plan would consider a review of Forest Practice Regulations and recommendations for best management practices and potential additional regulatory

measures or amendments needed to minimize GHG emissions and enhance carbon storage associated with silvicultural treatments (practice of controlling the establishment, growth, composition, health, and quality of forests to meet diverse needs and values). For example, a requirement for Sustained Yield Plans to demonstrate that activities not only maintain the current level of carbon sequestration, but actually increase carbon sequestration over the 100-year planning horizon.

(a) Wood Product Carbon Life Cycle Research

Development of a carbon life cycle analysis for wood products could also be considered. When utilizing wood products for construction, manufacturing, and sale of goods in California, the location of the initial raw wood should be considered along with an analysis of the associated carbon emissions from the processing and transport of wood products through the various steps of the supply chain. Guidelines could be established that identify and incentivize wood products that reduce carbon emissions–taking into account GHG emissions from transportation to the mill, from the mill to the production facility, and finally to the retailer. For example, wood harvested in California and transported and used locally for construction and manufacturing would have a lower carbon impact than wood that has been harvested and manufactured outside the State, shipped from overseas, or processed and reintroduced within California as a finished wood product.

ii) Land Use Planning to Enhance, Protect, and Conserve Lands in California

As described under the Agricultural Sector, an integrated and coordinated approach to local or State land use planning that considers all land types is important in meeting the State's GHG reduction goals. Urban, natural, and working lands and agricultural croplands within and across jurisdictions may all serve as interconnections between habitats and ecosystems. Local and regional land use planning actions and policies need to more fully integrate and emphasize land conservation and avoided conversion of croplands, forests, rangelands, and wetlands—as well as expand and promote urban forestry and green infrastructure. In addition, land use planning could include increased installation and maintenance of urban forests.

7. Short-Lived Climate Pollutants

a) Summary of Recommended Actions

The term "ozone depleting substances" (ODS) refers to a large group of chemicals known to destroy the stratospheric ozone layer when released into the atmosphere. ODS were historically used in a wide variety of applications, including refrigerants, foam blowing agents, solvents, and fire suppressants. In addition to their potency as ozone depleting substances, the ODS addressed by this protocol also exhibit high global warming potentials (GWP). The GWP of these ODS range from several hundred to several thousand times that of CO_2.

Four general concepts are associated with the Short-Lived Climate Pollutants Sector within the Proposed Update: high-GWP fluorinated gas (F-gas) phasedown, low-GWP

requirements, ODS recovery and destruction, and high-GWP fees. Recommended actions for Short-Lived Climate Pollutants are provided in Table 2-7.

Table 2-7 Key Recommended Actions for Short-Lived Climate Pollutants
• Develop a comprehensive strategy for mitigation of short-lived climate pollutants by 2015. • Continue diesel controls that will reduce black carbon emissions by 95 percent from the late 1960s to 2020. • Reduce emissions of smog-forming pollutants by about 90 percent below 2010 levels by 2032 to meet the national AAQS for ozone. • Create a collaborative agreement with the US EPA to establish national standards in alignment with the European Union (EU) proposed F-gas phasedown of hydrofluorocarbon (HFC) production and importation to 21 percent (by CO_2e) of baseline annual usage (years 2008-2011) by the year 2030. • Require low-GWP gases where feasible and cost-effective. • Incentivize recovery and destruction of ODSs at the end-of-life by a combination of strategies, including adjustments to current ODS destruction protocols, and/or implementing a mitigation fee. • Set an upstream mitigation fee on sales of high-GWP gases and sales or import of equipment pre-charged with high-GWP gases.

b) Compliance Responses

Reasonably foreseeable compliance responses would result in replacement of high-GWP compounds with low-GWP compounds. This could affect commercial refrigeration and air conditioning, transport refrigeration, aerosol propellant metered dose inhalers, solvents, fire suppressants, sulfur hexafluoride uses, and structural pesticide fumigants. Use of these replacement compounds, and related equipment, could result in the construction of new manufacturing facilities or modification of existing manufacturing facilities.

ODS recovery and destruction and replacement of high-GWP compounds with low-GWP compounds could be incentivized through mitigation fee programs. These incentives could increase the rate of ODS destruction and transitions from high-GWP to low-GWP gases and associated equipment.

8. Green Buildings

a) Summary of Recommended Actions

The Proposed Update includes development of a comprehensive GHG emission reduction program for new construction, existing building retrofits, and operation and maintenance of certified green buildings. This program would include an integrated approach to development of zero-net-carbon buildings (i.e., net zero carbon emissions

over a period of a year). Recommended actions for Green Buildings are provided in Table 2-8.

Table 2-8 Key Recommended Actions for Green Buildings
Develop a comprehensive GHG emission reduction program for new construction, existing building retrofits, and operation and maintenance of certified green buildings. Program development to be completed by end of 2017 and incorporate the following principles: • Achieve Executive Order goals for State buildings. • Build on California's existing ZNE building goals and activities by 2015. • Continue research activities to better quantify GHG emissions reduction potential of certified green buildings by 2016. • Strengthen the next two triennial editions (2016 and 2019) of the Green Building Standards Code with mandatory provisions ~~to~~ that ~~increase in stringency to progressively~~ reduce GHG emissions by 2017 and 2020 respectively. • Build on AB 758 Action Plan implementation activities, and explore opportunities to implement a portfolio of green building retrofit requirements at time-of-sale or other trigger mechanism by 2017. • Explore methodologies to quickly but accurately quantify direct and indirect GHG emissions from new and existing buildings by 2017. • By 2017, establish target dates and pathways toward transitioning to zero-net-carbon buildings that expand upon and complement ZNE goals. • By 2018, implement a mechanism to track progress toward achieving statewide green building goals.

b) Compliance Responses

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, retrofits of existing building, and operation and maintenance of certified green buildings. Reasonably foreseeable compliance responses associated with these recommended actions could consist of new requirements that result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar, wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms.

i) Zero-Net-Energy Buildings

Reasonably foreseeable compliance responses associated with ZNE buildings are described above under Section 2.C.1, Energy.

ii) Zero-Net-Carbon Buildings

Reasonably foreseeable compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in zero-net-carbon

buildings. Zero-net-carbon, or carbon-neutral, buildings could use high performance design solutions, generate renewable energy and heating on-site or locally, and employ other techniques to eliminate or offset GHG emissions from all GHG impacts associated with a building. Reasonably foreseeable compliance responses to achieve zero-net-carbon buildings could consist of increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and funding of carbon offset technologies.

9. Cap-and-Trade Regulation

a) Summary of Recommended Actions

Under the Proposed Update, the Cap-and-Trade Regulation would continue to be a vital component for achieving California's longer-term, emission-reduction goals. The Cap-and-Trade Regulation creates a gradually declining limit on the sources responsible for 85 percent of California's GHG emissions, establishes the price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy, and affords covered entities the flexibility to seek out and implement the lowest-cost options to reduce emissions. The Proposed Update includes a recommended action to continue the Cap-and-Trade Regulation with GHG emissions caps beyond 2020.

The Cap-and-Trade Regulation places an aggregated emissions cap on the total emissions generated by all covered facilities in the program. Over time, the cap will steadily decline. The cap is enforced by requiring each source that operates under the cap to turn in one allowance or offset credit (up to a maximum of 8% of the obligation) for every metric ton of CO_2e that it emits. The price of allowances is established by the marketplace based on supply and demand. Allowance prices efficiently inform consumption and investment decisions and stimulate the development of new technological solutions that can enable lower-cost reductions now and in the future. The Cap-and-Trade Regulation can also work in concert with direct regulatory measures. Many actions taken to comply with direct regulations can reduce an entity's compliance obligation under the Cap-and-Trade Regulation.

The Cap-and-Trade Regulation currently acknowledges the potential for GHG emission reductions from Carbon Capture and Sequestration (CCS), and states that covered entities may reduce their compliance obligations for each metric ton of CO_2e that has been proven to be sequestered using a Board-approved CCS quantification methodology. An approved methodology has not yet been adopted. The Proposed Update includes a recommended action in the Energy Sector to develop a CCS quantification methodology by 2017. When this methodology is completed and approved, covered entities in the Cap-and-Trade Regulation may be able to reduce their direct compliance obligation by deploying CCS projects at their covered facilities.

At the time of the development of the Proposed Update, staff is proposing a series of amendments to the Cap-and-Trade Regulation. These proposed amendments provide additional process for clarity of implementation, address stakeholder concerns on cost containment, add a new compliance offset protocol for Mine Methane Capture, and

extend transition assistance for covered entities in the program. The Initial Statement of Reasons (ISOR) and accompanying environmental analysis for these amendments is found at http://www.arb.ca.gov/regact/2013/capandtrade13/capandtrade13isor.pdf. In addition, ARB plans to propose the addition of a new Rice Cultivation Projects Compliance Offset Protocol and updates to existing Compliance Offset Protocols under the Cap-and-Trade Regulation at the September 2014 Board hearing.

a) Compliance Responses

Reasonably foreseeable compliance responses under a continuation of the Cap-and-Trade Regulation would be similar to those described under the existing Cap-and-Trade Regulation and the currently proposed amendments with the proposed offset protocol for Mine Methane Capture. The Proposed Update continues the existing Cap-and-Trade Regulation's provision allowing for additional offset protocols, which currently consist of U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance, as well as the provisions regarding sector-based offset crediting programs. Including any type of international sector-based offset credits from a jurisdictional sector-based offset program for Reducing Emissions from Deforestation and Forest Degradation (REDD) would not change the offset usage limit established in the Cap-and-Trade Regulation, but would help to ensure there are enough offsets available if the covered entities want to maximize their eight percent usage limit per compliance period. If California were to pursue a unilateral linkage for international offsets such as those from REDD, that would occur through a similar linkage type rulemaking process as the one conducted for linking with Québec. If ARB proposes any future rulemaking to include REDD offset credits, staff will prepare an environmental analysis for public and Board consideration.

Additionally, when the development of a CCS quantification methodology is completed and approved, reasonably foreseeable compliance responses under the extended Cap-and-Trade Regulation could include the deployment of CCS projects (see the Energy Sector section of this chapter for a detailed description of the recommended action and reasonably foreseeable compliance responses for CCS methodology development). If covered entities employed CCS projects to reduce their compliance obligations, there could also be a reduced need for offsets and allowances by covered entities.

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3.0 ENVIRONMENTAL AND REGULATORY SETTING

The California Environmental Quality Act (CEQA) Guidelines require an environmental impact report (EIR) to include an environmental setting section that discusses the current environmental conditions in the vicinity of the project. This environmental setting normally constitutes the baseline physical conditions against which an impact is compared to determine whether it is significant. (Cal. Code Regs., tit. 14, § 15125.) As discussed above in Chapter 1, the Air Resources Board (ARB) is exempt from preparing an EIR. However, in an effort to comply with the policy objectives of CEQA, an environmental setting and a regulatory setting with environmental laws and regulations relevant to the Proposed First Update to the Climate Change Scoping Plan (Proposed Update) have been included as Attachment 2 to this document.

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4.0 IMPACT ANALYSIS AND MITIGATION MEASURES

This chapter contains an analysis of environmental impacts and mitigation measures associated with the Proposed First Update to the Climate Change Scoping Plan (Proposed Update). Section A of this chapter begins with a review of the measures contained in the initial Scoping Plan and subsequent actions that the Air Resources Board (ARB) and others have taken to implement the measures. Section B of this chapter follows with an analysis of impacts associated with the recommended actions contained in the Proposed Update, including feasible mitigation measures that could reduce any potentially significant adverse impacts.

A. Prior Environmental Impact Analysis and Mitigation

As noted in Chapter 1, this Environmental Analysis (EA) supplements the California Environmental Quality Act (CEQA) Functional Equivalent Document (2008 FED) and 2011 Final Supplement to the Assembly Bill (AB) 32 Scoping Plan Functional Equivalent Document (2011 Supplement) prepared for the initial Scoping Plan, and builds upon other environmental documents prepared for specific GHG emission reduction regulations and related programs implemented since 2008. The impact analyses from these other documents are briefly summarized in Attachment 3 for each sector addressed in the initial Scoping Plan.

CEQA allows incorporation by reference for all or portions of other documents, when long, descriptive, or technical materials provide general background, but do not contribute directly to the analysis of the project under consideration. Thus, ARB hereby incorporates the relevant documents by reference, as they are cited in this EA. Incorporated documents are available on ARB's website at http://www.arb.ca.gov or in person at the Board Administration and Regulatory Coordination Unit of the Air Resources Board, located at 1001 I Street, Sacramento, California, 95814.

B. Impact Analysis and Mitigation Measures for the Proposed Update

The following discussion provides a programmatic environmental analysis of the reasonably foreseeable compliance responses that could result from implementation of the recommended actions in the Proposed Update, which are described in Chapter 2 of this EA. The impact analysis is organized by environmental resource areas in accordance with the topics presented in the Environmental Checklist in Appendix G to the CEQA Guidelines, with a discussion of potential impacts of recommended actions and associated compliance responses that could result in environmental impacts for each sector described in the Proposed Update. The reasonably foreseeable compliance responses associated with the project are analyzed in a programmatic manner for several reasons: (1) any individual action or activity would be carried out under the same authorizing statutory authority (i.e., the Global Warming Solutions Act of 2006); (2) the reasonably foreseeable compliance responses would result in generally similar environmental effects that can be mitigated in similar ways; (see Cal. Code Regs., tit.17, § 15168, subd. (a)(4)) and (3) while the types of foreseeable compliance responses can

be reasonably predicted, the specific location, design, and setting of the actions cannot feasibly be known at this time. If a later activity would have environmental effects that are not examined within this EA, the public agency with authority over the later activity would need to conduct additional environmental review, as necessary.

To consider the range of reasonably foreseeable compliance responses associated with recommended actions in the nine sectors identified in the Proposed Update, the following analysis addresses the impacts on the environment associated with both the recommended actions and the reasonably foreseeable compliance responses that may be required to implement the recommended action (e.g., expansion of manufacturing facilities for alternative fuel and/or zero-emission, heavy-duty vehicle technologies).

Some of the recommended actions are cross-cutting activities that could result in reasonably foreseeable compliance responses in multiple sectors in the Proposed Update. For example, carbon capture and sequestration (CCS) quantification methodology is a recommended action in the Energy Sector that could also result in reasonably foreseeable compliance responses in the Transportation Sector under the Low Carbon Fuel Standard (LCFS), and also under the Cap-and-Trade Regulation. In the case of CCS, potential impacts and mitigation related to this recommended action and associated compliance responses are covered under the Energy Sector. Impact discussions include, where relevant, construction-related effects, operational effects of new or modified facilities, and influences of the recommended actions on GHG and air pollutant emissions. Because the specific location, extent, and design of potential new and/or modified facilities cannot be known at this time, the impact discussions reflect a conservative assessment to describe the type and magnitude of effects that may occur (i.e., conservative in that the conclusions tend to overstate adverse effects). These impact discussions are followed by the types of mitigation measures that could be typically required to reduce potentially significant environmental impacts.

1. Aesthetics

a) Energy Sector

Impact 1.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to utility-scale renewable energy projects. Compliance responses could include: zero-net-energy (ZNE) design standards for homes and business, demand-response programs, distributed renewable energy generation, combined heat and power (CHP) systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar photovoltaic (PV) and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground

caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Some of the reasonably foreseeable compliance responses could be accomplished with minimal ground-disturbing activity. For instance, energy storage systems could be developed by modifying existing hydroelectric dams. Smart-grid technology includes installation of smart meters, which look similar to traditional energy meters and do not result in building modifications. Improvements to energy production, processing, storage, distribution, and transmission systems could be minimal, and consist of general housekeeping, vapor recovery valves, and frequent maintenance checks. While implementation and operation of some of these features could potentially alter the appearance of some existing visual settings, those that occur within the footprints of existing facilities would generally result in minimal adverse effects on aesthetic resources.

Construction of ZNE homes and businesses, CHP, and energy storage technologies would likely require the operation of new facilities or more than minimal modifications to existing facilities. In addition, to meet offset requirements, compliance responses may involve renewable energy and CCS project proposals. Renewable energy projects associated with these compliance actions could range from installation of solar panels and micro-turbines onto buildings (e.g., to create ZNE buildings or CHP systems) to large-scale energy generation facilities, such as solar PV and wind turbine farms, and geothermal plants.

Development of new facilities, although expected to occur in areas appropriately zoned, could conceivably introduce or increase the presence of visible artificial elements (e.g., heavy-duty equipment, vegetation removal, new or expanded buildings) in areas of scenic importance, such as visibility from a State scenic highways. The visual impact of such development would depend on several variables, including the type and size of facilities, distance and angle of view, visual prominence, and placement in the landscape. In addition, facility operation may introduce substantial sources of glare, exhaust plumes, and nighttime lighting for safety and security purposes.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Energy Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts associated with the Energy Sector could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of aesthetic resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities or infrastructure that

would be approved by other State agencies or local jurisdictions. The ability to require such measures is within the purview of jurisdictions with land use approval and/or permitting authority. Project-specific impacts and mitigation would be identified during the project review process carried out by agencies with approval authority. Recognized practices routinely required to avoid and/or minimize impacts to aesthetic resources include:

- Proponents of new or modified facilities or infrastructure constructed as a result of reasonably foreseeable compliance responses would coordinate with State or local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body must certify that the environmental document was prepared in compliance with applicable regulations prior to approval of a project for development.
- Based on the results of the environmental review, proponents would implement all feasible mitigation identified in the environmental document to reduce or substantially lessen the potentially significant scenic or aesthetic impacts of the project.
- The project proponent would color and finish the surfaces of all project structures and buildings visible to the public to: (1) minimize visual intrusion and contrast by blending with the landscape; (2) minimize glare; and (3) comply with local design policies and ordinances. The project proponent would submit a surface treatment plan to the lead agency for review and approval.
- To the extent feasible, the sites selected for use as construction staging and laydown areas would be areas that are already disturbed and/or are in locations of low visual sensitivity. Where feasible, construction staging and laydown areas for equipment, personal vehicles, and material storage would be sited to take advantage of natural screening opportunities provided by existing structures, topography, and/or vegetation. Temporary visual screens would be used where helpful, if existing landscape features did not screen views of the areas.
- All construction, operation, and maintenance areas would be kept clean and tidy, including the re-vegetation of disturbed soil and storage of construction materials and equipment would be screened from view and/or are generally not visible to the public, where feasible.
- Siting projects and their associated elements next to important scenic landscape features or in a setting for observation from State scenic highways, national historic sites, national trails, and cultural resources would be avoided to the greatest extent feasible.
- The project proponent would contact the lead agency to discuss the documentation required in a lighting mitigation plan, submit to the lead agency a plan describing the measures that demonstrate compliance with lighting requirements, and notify the lead agency that the lighting has been completed and is ready for inspection.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with Energy Sector actions would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 1.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The main types of recommended actions associated with the Transportation Sector include: (1) improving vehicle efficiency and develop zero-emission technologies; (2) reducing the carbon content of fuels and provide market support to encourage the use of these fuels; (3) planning for and implement sustainable communities to reduce vehicular GHG emissions and provide more transportation options; and (4) improving the efficiency and throughput of existing transportation systems.

These actions could result in the reasonably foreseeable compliance responses of an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or low- and zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Transportation Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.b: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with Transportation Sector actions would be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 1.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions associated with the Agriculture Sector involve GHG emission reduction and carbon sequestration opportunities. Farm and ranch management practices would be facility-specific and based upon facility size and types of and number of animals and crops. Reasonably foreseeable compliance responses could include: nitrogen management, such as the use of nitrification inhibitors or fertigation; methane (CH_4) capture from manure; and soil management practices, including changing tilling practices or cropping patterns. In addition, precision irrigation, and using the cleanest, most efficient, and well maintained equipment, and locally generated biofuels could reduce fuel use.

Furthermore, local and regional land use planning could be used to incentivize conservation easements, urban growth boundaries, and maintenance of agricultural zoning. Other planning efforts may include recommendations from the Bioenergy Action Plan that address economic, infrastructure, and regulatory limitations associated with the use of digester biogas into natural gas pipelines and bioenergy into the electric grid.

Reasonably foreseeable compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Relaxation of regulatory limitations associated with the use

of digester biogas in natural gas pipelines and bioenergy to supply the electricity grid could result in the installation of some equipment. However, these would likely constitute minor modifications to existing facilities.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Agriculture Sector, would be **less than significant**.

d) Water Sector

Impact 1.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. The construction and operation of new and/or modified recycled water and wastewater plants could occur; however, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Water Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.d: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with Water Sector actions would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 1.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the recommended actions in the Waste Management sector would be reasonably expected to result in construction and operation of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, reasonably foreseeable compliance responses may include installation of CH_4 control devices at existing landfills. While some of these activities could occur within existing landfills, the construction and operation of new facilities may be necessary to accommodate increased demand of organic waste diversion.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Waste Management Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.e: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the

programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with the Waste Management Sector actions would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 1.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: California Natural Resources Agency (CNRA), California Environmental Protection Agency (CalEPA), the Governor's Office of Planning and Research (OPR), California Department of Food and Agriculture (CDFA), California Department of Forestry and Fire Protection (CalFire), Board of Forestry and Fire Protection (BOF), California Department of Fish and Wildlife (CDFW), and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

Reasonably foreseeable compliance responses associated with the Natural and Working Lands Sector actions would generally aim to increase the amount of vegetation in existing urban areas and conserve natural and working landscapes. Enhancement of urban forests and protection of natural and working landscapes from conversion to urban development typically retain or improve natural features helping to define the aesthetic character of urban and rural areas. Thus, this aspect of implementation could be beneficial depending on the extent that conservation of natural lands and existing working lands is increased. However, in addition to compliance responses related to urban forests and land conservation, incentives could be created to encourage the use

of urban, agricultural, and forest wastes to produce electricity and transportation fuels. This could be accomplished through the construction and operation of biomass energy generation facilities. The location and size of these facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Natural and Working Lands Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.f: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities associated with Natural and Working Lands Sector actions would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 1.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes four types of recommended actions associated with the Short-Lived Climate Pollutants Sector: (1) high-global warming potential (GWP) fluorinated gas (F-gas) phasedown, (2) low-GWP requirements, (3) ozone-depleting substances (ODS); and (4) recovery and destruction, and high-GWP fees. Reasonably foreseeable compliance responses associated with the Short-Lived Climate Pollutant Sector actions could result in replacement of high-GWP compounds with low-GWP compounds. This could change the chemicals used in commercial refrigeration and air

conditioning, transport refrigeration, aerosol propellant metered dose inhalers, solvents, fire suppressants, sulfur hexafluoride (SF_6) uses, and structural pesticide fumigants. Increased demand for replacement compounds in these applications, and related equipment, could result in the construction and operation of new manufacturing facilities or modification of existing manufacturing facilities.

ODS recovery and destruction, and replacement of high-GWP compounds with low-GWP compounds could be incentivized through mitigation fee programs. These incentives could increase the rate of ODS destruction and support the transition from high-GWP to low-GWP gases and associated equipment. The increased demand for new low-GWP compounds and ODS destruction could result in new manufacturing facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that are appropriately zoned to accommodate them.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with the Short-Lived Climate Pollutants Sector, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.g: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with Short-Lived Climate Pollutants Sector actions would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 1.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, retrofits of existing building, and operation and maintenance of certified green buildings. Reasonably foreseeable compliance responses associated with these recommended actions could consist of new requirements that result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar, wind turbines, waste digesters), fuel cells, along with the construction and operation of carbon offset technologies, including solar PV or wind turbine farms.

The types of impacts on scenic vistas, scenic resources, visual character, and light and glare would be of similar type and magnitude as those discussed under Impact 1.a for the Energy Sector.

Short-term construction-related impacts and long-term operational impacts on aesthetics, associated with Green Buildings, would be potentially significant.

Potential scenic and nighttime lighting impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects.

Mitigation Measure 1.h: Implement Mitigation Measure 1.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant scenic and nighttime lighting impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational scenic and nighttime lighting impacts resulting from the development of new facilities or modification of existing facilities associated with recommended actions for Green Buildings would be **potentially significant and unavoidable.**

i) Cap-and-Trade Regulation

Impact 1.i

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the Functional Equivalent Document (FED) prepared for the California Cap on GHG Emissions and Market-Based Compliance Mechanisms (2010 Cap-and-Trade FED). This includes compliance responses to reduce GHG emissions by covered entities, continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses to reduce GHG emissions would consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities, and as such would not change the character of the project sites. The ODS Offset Protocol would not introduce activities that disrupt aesthetic or visual settings. The Livestock Offset Protocol would include the construction of digesters in agricultural settings. Digesters are consistent with agricultural uses and would not represent an adverse change to the visual character of the vicinity. The Urban Forest Offset Protocol would improve the quality of the urban visual environment and would be considered aesthetically beneficial. The Forest Offset Protocol would not increase the amount of forest activities, but could shift activities to projects that increase carbon sequestration. This shift could change the visual character of offset project sites over time, but would not pose an adverse visual impact. Managing forests to increase cover and remove dead and diseased trees may be a visually beneficial effect.

Impacts related to CCS are described above under the Energy Sector.

2. Agricultural and Forest Resources

a) Energy Sector

Impact 2.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to utility-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include energy-related facilities, such as solar PV and wind turbine farms, new CHP or CCS facilities, retrofit of existing facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to existing oil and gas pipelines (e.g., valves).

Construction of new renewable energy facilities and transmission lines from such facilities could result in the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, cancellation of Land Conservation (Williamson Act) ~~conservation~~ contracts and Farmland Security Zone contracts, or conversion of forest land or timberland, resulting in the loss of these resources. The conversion of agricultural and forest land to other uses could lead to a change in the land's ability to sequester carbon that would need to be evaluated.

Major solar or wind energy project proposals have not typically involved conversion of substantial areas of forest land for the energy generation facilities, themselves; however, transmission lines from new facilities have required alignments in forest land. It is reasonably foreseeable that forest land could be converted as a result of additional utility-scale renewable energy facility development.

In response to proposals for development of renewable energy projects on important farmland, local governments and the State have faced the challenge of balancing competing public interest in conserving agricultural land and meeting goals for expanding renewable energy generation. Utility-scale solar and wind energy facilities proposed to be located on ~~i~~Important ~~f~~Farmland and/or~~, including~~ property under Williamson Act contracts, have result~~ing~~ed in land use conversion. In 2013, a California appellate court upheld an EIR's evaluation of agricultural land impact and mitigation for a proposed solar project on ~~prime farmland~~ grazing land and Williamson Act contract land where a contract cancellation was proposed. The mitigation measures adopted by the lead agency in the case, included agricultural conservation easements and measures to restore the site after conclusion of the project's useful life. The court decision ~~also~~ confirmed that it was appropriate for the local lead agency to consider the

State's interest in increasing renewable energy generation as a reason to permit the cancellation of a Williamson Act contract (*Save Panoche Valley v. San Benito County, 2013, 217 Cal.App.4th 503).* Consequently, conversion of important farmland could occur in response to the recommended actions in the Energy Sector. Because ARB has no land use authority, mitigation is not within its purview to reduce potentially significant impacts to less-than-significant levels. While compliance with existing land use policies, ordinances, and regulations would serve to moderate this impact, because of local priorities for protection of agricultural land, the record of recent project approvals in the State demonstrate the impact has not been avoided.

As a result, short-term construction-related and long-term operational on agricultural and forest resource associated with Energy Sector actions would be potentially significant.

The~~i~~se impacts on agricultural and forest resources must be reviewed by local or State lead agencies in the context of future project approvals. The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of agricultural and forest resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities or infrastructure that would be approved by local jurisdictions. The ability to require such measures is within the purview of jurisdictions with local or State land use approval and/or permitting authority. Project-specific impacts and mitigation would be identified during the development review process carried out by agencies with project-approval authority. Recognized practices routinely required to avoid and/or minimize impacts to agricultural and forest land include:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance response to new regulations would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. ~~The definition of actions required to mitigate potentially significant agricultural and forest land impacts may include the following actions~~Because ARB has no land use authority, mitigation is not within its purview to reduce potentially significant impacts to less-than-significant levels. Any mitigation specifically required for a new or modified facility would be determined by the local lead agency and it

is recommended that future environmental documents by local and State lead agencies include analysis of the following:

- Avoidance of lands designated as Important Farmlands as defined by the Farmland Mapping and Monitoring Program.
- Analysis of the feasibility of using farmland that is not designated as Important Farmland prior to deciding on the conversion of Important Farmland.
- The feasibility, proximity, and value of the proposed project sites should be balanced before a decision is made to locate a facility on land designated as Important Farmland.
- Any action resulting in the conversion of Important Farmlands should consider mitigation for the loss of such farmland. Any such mitigation should be completed prior to the issuance of a grading or building permit by providing the permitting agency with written evidence of completion of the mitigation. Mitigation may include but is not limited to:
  - Permanent preservation of off-site Important Farmland (State defined Prime Farmland, Farmland of Statewide Importance, and Unique Farmland) of equal or better agricultural quality, at a ratio of at least 1:1.
  - Preservation may include the purchase of agricultural conservation easement(s); purchase of credits from an established agricultural farmland mitigation bank; contribution of agricultural land or equivalent funding to an organization that provides for the preservation of farmland towards the ultimate purchase of an agricultural conservation easement.
  - Participation in any agricultural land mitigation program, including local government maintained, that provides equal or more effective mitigation than the measures listed.

- ~~Avoidance of important agricultural and forest land, to the extent feasible.~~
- ~~The establishment and recording of a farmland or forest conservation easement to protect other land in the region.~~
- ~~The purchase of credits in an already-established, approved farmland mitigation bank.~~
- Contribution to county agricultural sustainability funds.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest resource impacts. Also, because public interest in agricultural and forest land conservation may compete with the public interest in expanding renewable energy generation, local agencies could decide to permit the conversion of agricultural and forest resources when approving proposed renewable energy facilities. Past approvals of renewable energy facilities by local governments have resulted in the recognition of an unavoidable significant adverse effect related to agricultural land conversion, even after adoption of all feasible mitigation measures. This does not, however, exempt local and/or State lead agencies from evaluating all feasible mitigation measures prior to project approval.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval in some circumstances, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest resource impacts resulting from the development of new facilities associated with Energy Sector actions would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 2.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improving vehicle efficiency and develop zero emission technologies; (2) reducing the carbon content of fuels and provide market support to encourage the use of these fuels; (3) planning for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improving the efficiency and throughput of existing transportation systems. These strategies could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Many local governments have adopted land use policies to protect important agricultural and forest land from conversion to urban development, including industrial facilities that may be constructed in response to the increased demand for alternative fuel and zero-emission vehicles. While it is reasonable to anticipate that land use policies controlling the location of new industrial facilities would generally avoid conversion of important agricultural land, the potential cannot be entirely dismissed. If a proposed facility were located on important farmland or property under a Williamson Act Contract, conversion of the agricultural land to urban uses would be a potentially significant impact.

As a result, short-term construction-related and long-term operational agricultural and forest resource impacts of Transportation Sector actions would be potentially significant.

Potential agricultural and forest resource impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local or State land use or permitting agencies with approval authority over the particular development projects. However, because ARB has no land use authority, mitigation is not within its purview to reduce potentially significant impacts to less-than-significant levels.

Mitigation Measure 2.b: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest land impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest resource impacts resulting from the development of new facilities or modification of existing facilities associated with Transportation Sector actions would be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 2.c

Short-Term Construction-Related Impacts

Reasonably foreseeable compliance responses associated with the recommended actions in the Agriculture Sector would incentivize onsite management practices and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new

equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands.

Thus, short-term construction-related impacts on agricultural and forest resources, associated with the Agriculture Sector, would be **less than significant.**

Long-Term Operational Impacts

Overall, implementation of recommendations associated with the Agriculture Sector would increase conservation of agriculture and forest resources.

Therefore, the Proposed Update could result in a **beneficial** long-term operational impact to agricultural and forest resources.

d) Water Sector

Impact 2.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. The construction and operation of new and/or modified recycled water and wastewater plants could occur; however, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts on farmland, zoning for agricultural use or Williamson Act Contract, and forest land and timberland would be of similar type and magnitude as those discussed under Impact 2.a under the Energy Sector.

Short-term construction-related impacts and long-term operational impacts of Water Sector actions on farmland, zoning for agricultural use or Williamson Act Contract, Forest Land, and Timberland would be potentially significant.

This impact on agricultural and forest resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.d: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest land impacts. Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest land impacts resulting from the development new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 2.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the recommended Waste Management Sector actions could in reasonably foreseeable compliance responses that include construction and operation of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling, development of biomass facilities, and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

The types of impacts on farmland, zoning for agricultural use or Williamson Act Contract, and forest land and timberland would be of similar type and magnitude as those discussed under Impact 2.a under the Energy Sector.

Short-term construction-related and long-term operational impacts of Waste Management Sector actions on farmland, zoning for agricultural use or Williamson Act Contract, Forest Land, and Timberland would be potentially significant.

This impact on agricultural and forest resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.e: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest land impacts. Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest land impacts resulting from the development new facilities or modification of existing facilities associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 2.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

However, in addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could result in the construction and operation of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass power facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The fuel source for biomass facilities is generally woody biomass acquired primarily from hazardous fuel removal, forest thinning, and other forest management activities. Removal of woody biomass from the surrounding forests could modify habitat for

common and special-status species, degrade sensitive habitats, and/or result in fill of jurisdictional waters of the United States. However, forest projects that would generate the woody biomass are separate projects that would be subject to separate environmental review and permitting. The generation of woody biomass would occur regardless of the proposed biomass project. Disposal of the woody biomass at these types of facilities in lieu of other disposal methods such pile burning would not have a substantial, long-term effect on forest resources.

Construction of new renewable energy facilities and transmission lines from such facilities could result in the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, Williamson Act conservation contracts, or forest land or timberland, resulting in the loss of these resources. Major solar or wind energy project proposals have not typically involved conversion of substantial areas of forest land for the energy generation facilities, themselves; however, transmission lines from new facilities have required alignments in forest land. It is reasonable to anticipate that forest land could be converted as a result of additional utility-scale renewable energy facility development.

In response to proposals for development of renewable energy projects on important farmland, local governments and the State have been forced to face the challenge of balancing the sometimes competing public interest in conserving agricultural land and meeting goals for expanding renewable energy generation. Utility-scale solar and wind energy facilities proposed to be located on important farmland, including property under Williamson Act contracts, have resulted in land conversion. In 2013, a California appellate court upheld an EIR's evaluation of agricultural land impact and mitigation for a proposed solar project on prime farmland and Williamson Act contract land where a contract cancellation was proposed. The court decision also confirmed that it was appropriate for the local lead agency to consider the State's interest in increasing renewable energy generation as a reason to permit the cancellation of a Williamson Act contract (*Save Panoche Valley v. San Benito County, 2013, 217 Cal.App.4th 503).* Consequently, it is reasonable to anticipate that conversion of important farmland could occur in response to the recommended actions in the Natural and Working Lands Sector.

Thus, short-term construction-related impacts and long-term operational impacts on agricultural and forest resources associated with the Natural and Working Lands Sector would be potentially significant.

This impact on agricultural and forest resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.f: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address

project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest land impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest land impacts resulting from the development new facilities or modification of existing facilities associated with the Natural and Working Land Sector would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 2.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

As described above, the increased demand for new low-GWP compounds, and ODS destruction could result in the construction and operation of new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of impacts of the Short-Lived Climate Pollutant Sector on farmland, zoning for agricultural use or Williamson Act Contract, and forest land and timberland would be of similar type and magnitude as those discussed under Impact 2.a under the Energy Sector.

Short-term construction-related and long-term operational impacts of the Short-Lived Climate Pollutants Sector on farmland, zoning for agricultural use or Williamson Act Contract, Forest Land, and Timberland would be potentially significant.

This impact on agricultural and forest resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.g: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant agricultural or forest land impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative

approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts and long-term operational agricultural and forest land impacts resulting from the development of new facilities or modification of existing facilities associated with the Short-Lived Climate Pollutants Sector would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 2.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions for Green Buildings include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, along with the construction and operation of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

New activities, including buildings, and renewable energy supply installations could be placed on land that is currently used for agricultural purposes.

The types of impacts on farmland, zoning for agricultural use or Williamson Act Contract, and forest land and timberland would be of similar type and magnitude as those discussed under Impact 2.a under the Energy Sector.

Short-term construction-related impacts and long-term operational impacts of Green Buildings on farmland, zoning for agricultural use or Williamson Act Contract, Forest Land, and Timberland would be potentially significant.

This impact on agricultural and forest resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 2.h: Implement Mitigation Measure 2.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant agricultural or forest land impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational agricultural and forest land impacts resulting from the development new facilities or modification of existing facilities associated with Green Buildings would be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 2.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update and is incorporated by reference. Impacts described in the 2010 Cap-and-Trade FED are summarized below and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities would not be expected to impact agriculture or forest resources.

Implementation of projects under the ODS Offset Protocol does not include activities that impact agriculture or forest resources. Implementation of projects under the Livestock Offset Protocol does include the construction of digesters in agricultural settings. Digesters are consistent with agricultural uses and would not represent an adverse change to agriculture or forest resources. Implementation of projects under the Urban Forest Offset Protocol does not impact agriculture or forest resources. Implementation of projects under the Forest Offset Protocol does not increase the amount of forest activities, but could shift activities to projects that increase carbon sequestration. Managing forests to increase cover and remove dead and diseased trees may be considered a beneficial impact to forests. Implementation of projects under the Forest Offset Protocol does not include actions that would encourage the conversion of agricultural land to forest.

Impacts related to CCS are described above under the Energy Sector.

3. Air Quality

a) Energy Sector

Impact 3.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Proposed development of new or modified manufacturing facilities would be required to secure local or State land use approvals prior to their implementation. Part of the development review and approval process requires that projects undergo environmental review consistent with California environmental laws (e.g., CEQA) and other applicable local requirements (e.g., local air quality management district rules and regulations). This environmental review process would include an assessment of whether project implementation would result in short-term construction-related air quality impacts.

At this time, the specific location, type, and number of construction activities is not known and would be dependent upon a variety of factors that are not within the control or authority of ARB and not within its purview. Nonetheless, the analysis presented herein provides a good-faith disclosure of the types of construction emission impacts that could occur with implementation of these reasonably foreseeable compliance responses. Further, subsequent environmental review would be conducted at such time that an individual project is proposed and land use or construction approvals are sought.

During the construction phase, criteria air pollutants (CAPs) and toxic air contaminants (TACs) could be generated from a variety of activities and emission sources. These emissions would be temporary and occur intermittently depending on the intensity of construction on a given day. Site grading and excavation activities would generate fugitive particulate matter (PM) dust emissions, which is the primary pollutant of concern during construction. Fugitive PM dust emissions (e.g., respirable particulate matter [PM_{10}] and fine particulate matter [$PM_{2.5}$]) vary as a function of several parameters, such as soil silt content and moisture, wind speed, acreage of disturbance area, and the intensity of activity performed with construction equipment. Exhaust emissions from off-road construction equipment, material delivery trips, and construction worker-commute

trips could also contribute to short-term increases in PM emissions, but to a lesser extent. Exhaust emissions from construction-related mobile sources also include reactive organic gases (ROG) and oxides of nitrogen (NO_X). These emission types and associated levels fluctuate greatly depending on the particular type, number, and duration of usage for the varying equipment.

The site preparation phase typically generates the most substantial emission levels because of the on-site equipment and ground-disturbing activities associated with grading, compacting, and excavation. Site preparation equipment and activities typically include backhoes, bulldozers, loaders, and excavation equipment (e.g., graders and scrapers). Although detailed construction information is not available at this time, based on the types of activities that could be conducted, it would be expected that the primary sources of construction-related emissions include soil disturbance- and equipment-related activities (e.g., use of backhoes, bulldozers, excavators, and other related equipment). Based on typical emission rates and other parameters for above mentioned equipment and activities, construction activities could result in hundreds of pounds of daily NO_X and PM emissions, which may exceed general mass emissions limits of a local or regional air quality management district depending on the location of generation. Thus, implementation of new regulations and/or incentives could generate levels that conflict with applicable air quality plans, exceed or contribute substantially to an existing or projected exceedance of State or national AAQS, result in a cumulatively considerable net increase in non-attainment areas, or expose sensitive receptors to substantial pollutant concentrations.

As a result, short-term construction-related air quality impacts associated with the Energy Sector would be potentially significant.

This short-term construction-related air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 3.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of air quality. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is within the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would likely qualify as a “project” under CEQA, because they would generally need a discretionary public agency approval and could affect the physical environment. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices routinely required to avoid and/or minimize impacts to air quality include the following:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance responses would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local jurisdiction with land use authority would determine that the environmental review process complied with CEQA and other applicable regulations, prior to project approval.
- Based on the results of the environmental review, proponents would implement all feasible mitigation identified in the environmental document to reduce or substantially lessen the construction-related air quality impacts of the project.
- Project proponents would apply for, secure, and comply with all appropriate air quality permits for project construction from the local agencies with air quality jurisdiction and from other applicable agencies, if appropriate, prior to construction mobilization.
- Project proponents would comply with the Clean Air Act and the California Clean Air Act (e.g., New Source Review and Best Available Control Technology criteria if applicable).
- Project proponents would comply with local plans, policies, ordinances, rules, and regulations regarding air quality-related emissions and associated exposure (e.g., construction-related fugitive PM dust regulations, indirect source review, and payment into offsite mitigation funds).
- For projects located in PM nonattainment areas, prepare and comply with a dust abatement plan that addresses emissions of fugitive dust during construction and operation of the project.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts resulting from the development of new facilities or modification of existing facilities associated with Energy Sector actions would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

As discussed above, the reasonably foreseeable compliance responses could include a number of different types of new facilities or modifications to existing facilities, such as

CHP and/or CCS. Within a more regional perspective, large-scale facilities such as CHP can offer substantially lower CAP and GHG emission rates compared with conventional power generating and/or thermal heating systems operating within the same region. As noted in the energy demand section below, these technologies have the potential to displace the operation of existing, or reduce the need for new, conventional electricity and heating systems within the same region. Thus, implementing actions to support increased CHP facility development and other reasonably foreseeable compliance responses could be beneficial to regional air quality conditions.

In addition, reasonably foreseeable compliance responses associated with the Energy Sector also include operation of renewable energy projects, such as solar PV farms and wind turbine farms. These types of projects could result in an indirect emission reduction by displacing emissions associated with fossil-fuel fired power plant electricity generation that otherwise would occur. Thus, implementing such actions could also be beneficial to air quality conditions through replacement of coal, or other fossil-fueled power plants.

However, the operation of CHP and/or CCS systems or other technologies at an existing or new facility could adversely affect local air quality emissions. The amount and type of CAPs and TACs would depend on the type of technology used. Table 4-1 shows the primary pollutants from some CHP technologies that may be considered under new regulations developed in response to recommended actions in the Proposed Update.

Table 4-1 Primary Pollutants from CHP Technologies

CHP Technology	Primary Pollutants
Gas Turbines	NO_X, CO, VOCs (non-methane, non-ethane hydrocarbons due to incomplete combustion), SO_X, PM, and CO_2 depending on the fuel used
Microturbines	NO_X, CO, VOCs, negligible amount of SO_2, and CO_2 depending upon fuel used
Fuel Cell Systems	CO, NO_X, negligible SO_X, and CO_2 depending upon fuel used

Notes: NO_X = oxides of nitrogen; CO=carbon monoxide; VOCs=volatile organic compounds; SO_X = oxides of sulfur; PM=particulate matter
Source: EPA 2008

Stationary sources (e.g., CHP or CCS) that generate CAPs and/or TACs would be required to obtain authorities to construct and permits to operate from the applicable local air district. In addition, stationary sources would be required by law to comply with all applicable air district rules and regulations for CAPs and TACs (e.g., new source review, implementation of best available control technologies and control measures). The permit process along with adherence to all applicable rules and regulations require that these sources be equipped with the required emission controls and that,

individually, these sources would not result in emissions that exceed applicable thresholds. In addition, non-permitted sources of emissions (e.g., employee commute trips and deliveries) would be anticipated to be minor.

Long-term operational air quality impacts associated with the Energy Sector would be **less than significant**.

b) Transportation Sector

Impact 3.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on air quality would be of similar type and magnitude as those discussed under Impact 3.a under the Energy Sector.

Short-term construction-related impacts associated with the Transportation Sector on air quality would be potentially significant.

Mitigation Measure 3.b (1): Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts resulting from the development of new facilities or modification of existing facilities associated with the Transportation Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Despite the dramatic emission reductions and air quality improvements achieved to date, most urban areas of California, including Southern California, the Bay Area, and the Central Valley continue to exceed the national AAQS for ozone. ARB, the South Coast Air Quality Management District, and the San Joaquin Valley Air Pollution Control District are beginning to evaluate the emission reductions needed to attain the more health-protective ozone standard US EPA established in 2008. In order to meet these challenges, air quality and land-use agencies in the South Coast and San Joaquin Valley are actively pursuing a coordinated strategy that results in the widespread use of zero-emission technologies on transportation networks designed to reduce smog forming emissions from single occupant vehicle use.

Strategies that would improve vehicle efficiency and develop zero-emission technologies would reduce emissions from conventional gasoline and diesel trucks because new fleets would contain vehicles that would be rated as low- or no-emission transport systems. Over time, older vehicles would be replaced with similar low- or no-emission vehicles. This would eliminate a substantial amount of air pollutants associated with diesel- and gasoline-fueled trucks as they would increasingly make up a smaller percentage of vehicles. While the specific compliance measures would require evaluation to determine the anticipated results of this regulation, reductions in CAPs would be expected as these reasonably foreseeable compliance responses are implemented. In addition, communities would be planned to improve transportation options and system, thereby reducing the use of personal vehicles. Reductions in personal vehicle use could provide benefits to air quality.

Battery-powered electric vehicles require electricity, which could be generated from fossil fuels. Generation of electricity from fossil fuels results in emissions, including SO_2, NO_X, PM, and CO_2 depending on the source (e.g., coal, natural gas, solar). These would constitute stationary source emissions. Stationary sources that generate CAPs and/or TACs would be required to obtain authorities to construct and permits to operate from the applicable local air district. In addition, stationary sources would be required by law to comply with all applicable air district rules and regulations for CAPs and TACs (e.g., new source review, implementation of best available control technologies and control measures). The permit process along with adherence to all applicable rules and regulations would require these sources be equipped with the required emission controls and that, individually, these sources would not result in emissions that exceed applicable thresholds. In addition, non-permitted sources of emissions (e.g., employee commute trips and deliveries) would be anticipated to be minor.

Transportation fuels included in the LCFS are produced from a variety of feedstocks. These feedstocks include crude oil, natural gas, biomass material, biowaste material, waste grease, animal tallow, and municipal solid waste. Relative to petroleum diesel emissions from engine combustion, biodiesel emissions have been shown to contain less PM, hydrocarbons, carbon monoxide, and polycyclic aromatic hydrocarbons. However, available measurements indicate that the combustion of higher biodiesel blends in certain diesel engines can increase the release of NO_X, which, in addition to its association with potential health effects, has been identified as an ozone precursor. (Cal/EPA Multimedia Working Group 2013).

Long-term operational impacts of the Transportation Sector on air quality are considered to be potentially significant.

Mitigation Measure 3.b(2)

Given the wide variety of oils and fats that could be used to make biodiesel fuel, the actual emissions of PM and TAC should be considered for each proposed formulation of biodiesel fuel to be used in California. This situation requires a systematic and ongoing effort to assess emissions from diesel engines. But it should be recognized that, due to the large number of fuel formulations along with the resources and cost required to evaluate each formulation, it is not feasible to assess all combinations of engine types and fuel formulations. This is especially the case with additives, since the number of additive and feedstock combinations could be large. ARB is developing a regulatory process by which alternative diesel fuels are evaluated so that any appropriate restrictions can be imposed as new fuels are introduced into the market.

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of air quality. ARB is the lead agency for the LCFS Program, and is currently preparing an EA for proposed LCFS amendments, in compliance with CEQA and ARB's certified regulatory program, to assess the environmental effects associated with implementation of various low-carbon fuel options. The LCFS EA will include an analysis of the direct and indirect impacts associated with feedstock production, transportation to facilities, alternative fuels production, the use of those fuels, and other components of the LCFS program. Because proposed LCFS amendments are still under development, this EA does not attempt to address the specific details of potential impacts associated with implementation of that program or mitigation that may be implemented to reduce any adverse environmental impacts identified. Thus, this EA conservatively assumes, based upon information prepared by the California EPA Multimedia Working Group, that increased NO_X emissions could be associated with combustion of some higher biodiesel blends in certain diesel engines (Cal/EPA 2013).

The potential increases in NO_X emissions associated with combustion of some higher biodiesel blends is expected to be reduced to a less-than-significant level through the regulatory process by which alternative diesel fuels are evaluated so that any appropriate restrictions can be imposed as new fuels are introduced into the market. However, because that process has not been completed at this time, this EA takes the

conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes in this EA, that long-term operational impacts on air quality associated with the Transportation Sector could be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 3.c

Short-Term Construction-Related Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in construction-related activities.

Thus, short-term construction-related air quality impact associated with the Agriculture Sector would be **less than significant**.

Long-Term Operational Impacts

Reasonably foreseeable compliance responses associated with the Agriculture Sector could include a variety of practices that would reduce N_2O, and CO_2 emissions through fertilization practices, soil management practices, and reductions in fuel and water use. In addition, the production of biofuels could offset air quality emissions associated with fossil-based fuels.

Development and implementation of these types of compliance responses for the Agricultural Sector would result in **beneficial** long-term operational air quality impacts.

d) Water Sector

Impact 3.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within

State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of short-term construction-related impacts associated with the Water Sector on air quality would be of similar type and magnitude as those discussed under Impact 3.a for the Energy Sector, and would be potentially significant.

This short-term construction-related air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.d: Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts resulting from the development of new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Recommended actions associated with the Water Sector could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Air quality impacts associated with new facilities or modifications to existing facilities could generate long-term emissions associated with recycling water and wastewater plants operations. The quantity of emissions would be dependent of the types of technologies installed, and may include VOC, NO_X, and PM. However, stationary sources that generate CAPs and/or TACs would be required to obtain authorities to construct and permits to operate from the applicable local air district. In addition, stationary sources would be required by law to comply with all applicable air district rules and regulations for CAPs and TACs (e.g., new source review, implementation of best available control technologies and control measures). The permit process along with adherence to all applicable rules and regulations would require these sources be equipped with the required emission controls and that, individually, these sources would not result in emissions that exceed applicable thresholds. In addition, non-permitted sources of emissions (e.g., employee commute trips and deliveries) would be anticipated to be minor.

Long-term operational impacts on air quality associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 3.e

Short-Term Construction-Related Impacts

Implementation of the recommended actions in the Waste Management sector could result in a number of reasonably foreseeable compliance responses, including the construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and reduction of methane emissions from organics in the waste stream. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location of any new facilities or modification of existing facilities. However, these would likely occur within

existing developed area footprints or in areas with zoning that would permit the development of manufacturing or industrial uses.

The types of construction-related impacts on air quality would be of similar type and magnitude as those discussed under Impact 3.a under the Energy Sector.

Short-term construction-related impacts on air quality, associated with the Waste Management Sector would be potentially significant.

This short-term, construction-related, air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.e(1): Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts resulting from the development of new facilities or modification of existing facilities associated with the Waste Management Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Emissions associated with digester operations would depend on several factors, such as the size and type of anaerobic digestion facility (e.g., one-stage or two-stage continuous systems, batch systems, wet or dry processes), any equipment needed for pre-processing, the increased traffic on the local and regional roadway network (including additional waste haul trucks and employees), and the post processing of the biogas (e.g., flaring of excess biogas, combusting for electricity, or cleaning up biogas for use as a transportation fuel or injection to utility transmission lines). Operational sources of fugitive dust would primarily be processing equipment and truck movement over paved and unpaved surfaces. In addition, non-methane VOCs released from pre-digested substrate materials during the receipt and pre-processing activities at anaerobic digestion facilities would not be a regional change, but could result in an increase in local emissions. Although there will be emissions associated with these sources at anaerobic digestion facilities, the operation of these facilities would divert organics out of landfills. By doing so, there would be less activity at the landfill, such as potentially fewer pieces of off-road equipment and a potential decrease in the vehicle

miles traveled VMT for haul trucks. The anaerobic digestion facilities could also generate biogas to replace fossil fuels for electricity production or for vehicle transportation.

Stationary sources that generate CAPs and/or TACs would be required to obtain authorities to construct and permits to operate from the applicable local air district. In addition, stationary sources would be required by law to comply with all applicable air district rules and regulations for CAPs and TACs (e.g., new source review, implementation of best available control technologies and control measures). The permit process along with adherence to all applicable rules and regulations would require these sources be equipped with the required emission controls and that, individually, these sources would not result in emissions that exceed applicable thresholds. In addition, non-permitted sources of emissions (e.g., employee commute trips and deliveries) would be anticipated to be minor.

Long-term operational air quality impacts associated with the Waste Management Sector would be **less than significant**.

Odors

Implementation of the recommended actions in the Waste Management sector could result in a number of reasonably foreseeable compliance responses, including the construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and reduction of methane emissions from organics in the waste stream. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

Factors that would affect potential odor impacts include the design of proposed anaerobic digestion or composting facilities, sensitive receptor proximity, and exposure duration. Anaerobic digestion is the biological decomposition of organic matter in the absence of molecular oxygen. As a result, odorous compounds, such as ammonia and hydrogen sulfide (H_2S), are generated and could be released into the environment. The anaerobic digestion process occurs naturally in marshes, wetlands and is the principal decomposition process in landfills. However, in the operation of anaerobic digestion facilities, processes occur in a closed system. VOCs are broken down through the anaerobic digestion process, and exhaust is generally processed in a more controlled environment.

However, the collection transport, storage, and pre-processing activities of the potentially odiferous organic substrates for digestion and the resultant digestate could produce nuisance odors at anaerobic digestion facilities. Similarly, the collection, transport, storage and pre-processing of organic materials for composting could also produce nuisance odors. The siting of these facilities could lead to objectionable odors at off-site receptors in the vicinity.

Thus, long-term operation-related odor impacts associated with the Waste Management Sector could be potentially significant.

Potentially significant odor impacts could be reduced to a less-than-significant level by mitigation measures prescribed by local lead agencies with approval authority over the particular development projects.

Mitigation Measure 3.e(2):

Applicants for the development of anaerobic digestion facilities would be required to comply with appropriate local or State land use plans, policies, and regulations, including applicable setbacks and buffer areas from sensitive land uses for potentially odoriferous processes. If an anaerobic digestion or composting facility would handle organic or compostable material and is classified as a compostable material handling facility, the facility must develop an Odor Impact Minimization Plan (OIMP) pursuant to 14 CCR 17863.4. Otherwise, applicants shall develop and implement an Odor Management Plan (OMP) that incorporates equivalent odor reduction controls for digester operations. Odor control strategies that could be incorporated into these plans include, but are not limited to, the following:

- A list of potential odor sources.
- Identification and description of the most likely sources of odor.
- Identification of potential, intensity, and frequency of odor from likely sources.
- A list of odor control technologies and management practices that could be implemented to minimize odor releases. These management practices would include the establishment of the following criteria:
    - Require substrate haulage to the AD facility within sealed containers.
    - Establish time limit for on-site retention of undigested substrates (i.e., substrates must be put into the digester within 24 hours of receipt).
    - Provide enclosed, negative pressure buildings for indoor receiving and preprocessing. Treat collected foul air in a biofilter or air scrubbing system.
    - Establish contingency plans for operating downtime (e.g., equipment malfunction, power outage).
    - Manage delivery schedule to facilitate prompt handling of odorous substrates.
    - Handle digestate within enclosed building and/or directly pump to sealed containers for transportation.
    - Protocol for monitoring and recording odor events.
    - Protocol for reporting and responding to odor events.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant odor-related impacts.

Consequently, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that long-term operational odor-related impacts associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 3.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

Reasonably foreseeable compliance responses associated with the Natural and Working Land Sector could encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations with appropriate zoning.

The types of construction-related impacts on air quality would be of similar type and magnitude as those discussed under Impact 3.a under the Energy Sector.

Construction-related impacts on air quality associated with the Natural and Working Lands Sector would be potentially significant.

This short-term construction-related air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.f(1): Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts associated with the Natural and Working Land Sector, would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Recommended actions under the Natural and Working Lands Sector include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs. These types of projects would improve air quality in two ways: (1) through the CO_2 sequestration benefits of grasslands, scrublands, and wetlands; and (2) forest management practices that could reduce the potential for wildfires, and therefore potential PM emissions. While these actions would not provide immediate benefit, over time they would lead to beneficial air quality effects.

However, recommended actions associated with the Natural and Working Lands Sector could result in development of biomass facilities. Biomass facilities convert biomass, such as woody wastes from forest residues to useful steam, heat, or combustible gases. The two basic types of conversions systems consist of gasification and direct combustion for electricity generation. Gasification systems generate electricity through combustion of syngas (i.e., synthetic gas produced from the conversion of organic

solids and liquids under heat and controlled air or oxygen); and direct combustion systems burn biomass in a furnace, which supplies heat to a boiler that produces steam. Syngas, from gasification systems, are used to generate electricity in an internal combustion engine or turbine. Steam, from direct combustion systems, generates electricity through the use of a steam turbine.

Combustion systems would generate varying levels of NO_X, ROG, SO_X, PM_{10}, and $PM_{2.5}$. In addition, operational activities would result in emissions of CAPs and TACs, including the chipping of biomass before it is hauled to the plant, trucks hauling biomass to the plant and idling at the project site on both paved and unpaved roads, operation of a loader at the plant and fuel yard, employee commute trips, and trucks hauling waste byproducts (e.g., biochar) away from the plant.

Without project specific details, it is not possible to determine if long-term operational emissions would result in a violation or substantial contribution to an existing air quality violation, exposure of sensitive receptors to substantial pollutant concentration, and/or conflict with air quality planning efforts. However, because air quality planning efforts are regional in nature, accounting of CAPs and TACs should be limited to the air basin in which reductions occur. However, project proponents would be required to coordinate with local or State land use agencies, and seek entitlement for development of the project, including the completion of all necessary environmental review requirements. While it can reasonably be assumed that new biomass facilities would be required to obtain stationary source permits, it is not possible to determine the level emissions from all associated non-permitted operations (e.g., hauling, commuter trips, chipping).

Thus, long-term operational air quality impacts associated with the Natural and Working Lands Sector could be potentially significant.

This operational air quality impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.a(2)

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of air quality. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is within the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would likely qualify as a “project” under CEQA, because they would generally need a discretionary public agency approval and could affect the physical environment. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices routinely required to avoid and/or minimize impacts to long-term air quality emissions include the following:

- Heavy-duty construction equipment shall be maintained in proper working condition according to manufacturer's specifications. Prior to start-up of plant operations, the applicant shall provide a plan, for approval by the local planning department and air pollution control district. Acceptable options for reducing emissions may include use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available. The applicant or its representative shall submit to the local planning department and air pollution control district the specification of both the dozer and loader, including the horsepower rating, engine production year, and projected average daily hours of use for each piece of equipment. If either equipment item is replaced in the future the plant operator shall select a model that is at least as efficient as the previous model with respect to its rate of NO_X emissions.

- Operators of heavy-duty construction equipment shall minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes (as required by the state airborne toxics control measure [Title 13, Section 2485 of the California Code of Regulations]).

- Haul trucks shall be prohibited from idling while dumping their biomass load at the truck dump. The plant operator shall provide clear signage that posts this requirement s for truck drivers at the entrances to the site and at the truck dumps.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, operational emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that long-term operational air quality impacts associated with Natural and Working Sector actions would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 3.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related impacts on air quality, associated with the Short-Lived Climate Pollutants Sector, would be of similar type and magnitude as those discussed under Impact 3.a under the Energy Sector.

Construction-related impacts on air quality associated with the Short-Lived Climate Pollutants Sector would be potentially significant.

This short-term, construction-related, air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.g: Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts associated with the Short-Lived Climate Pollutants Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Incineration of CFCs and HCFCs could result in emissions of hydrofluoric acid, HCl, Cl2, organic acids, products of incomplete combustion (PICs), dioxins, and furans. These compounds are classified as TACs.

However, stationary sources that generate TACs would be required to obtain authorities to construct and permits to operate from the applicable local air district. In addition, stationary sources would be required by law to comply with all applicable air district rules and regulations for TACs (e.g., new source review, implementation of best available control technologies and control measures). The permit process along with adherence to all applicable rules and regulations would require these sources be equipped with the required emission controls and that, individually, these sources would not result in emissions that exceed applicable thresholds. In addition, non-permitted sources of emissions (e.g., employee commute trips and deliveries) would be anticipated to be minor.

Long-term operational air quality impacts associated with the Short-Lived Climate Pollutant Sector would be **less than significant**.

h) Green Buildings

Impact 3.h

Short-Term Construction-Related Impacts

The recommended actions for Green Buildings include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with these recommended actions could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

The types of construction-related impacts on air quality associated with Green Buildings would be of similar type and magnitude as those discussed under Impact 3.a under the Energy Sector.

Short-term construction-related impacts on air quality associated with Green Buildings would be potentially significant.

This short-term construction-related air quality impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 3.h: Implement Mitigation Measure 3.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of

mitigation that may ultimately be implemented to reduce potentially significant impacts. With mitigation, construction emissions, though not likely, could still exceed local air district threshold levels of significance depending on the magnitude of construction activities.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related air quality impacts associated with Green Buildings would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the recommended actions in Green Buildings would encourage the use of several technologies that reduce energy demand compared to the existing housing stock. These reasonably foreseeable compliance responses include high-performance design solutions (energy efficiency), renewable energy facilities, and on-site or locally generated heat sources. In addition, communities could be planned to provide efficient transportation systems, and designs that encourage people to walk or bike, rather than using personal vehicles. Thus, recommended actions associated with Green Buildings would result in reductions in demand for electricity, natural gas, and transportation fuels and; consequently, reductions in associated CAPs and TACs.

Long-term operational air quality impacts associated with Green Buildings would be **beneficial**.

i) Cap-and-Trade Regulation

Impact 3.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are summarized below and detailed in Attachment 3 of this EA.

The Cap-and-Trade Regulation is designed to reduce GHG emissions. However, measures that reduce GHG emissions are expected to provide co-benefits as reductions of CAPs and TACs. Statewide, the level of GHG, CAPs, and TACs is

expected to be reduced as a result of the Cap-and-Trade Regulation. This is a beneficial effect.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involve construction, grading and trenching which have the potential to result in short-term construction-related air quality impacts. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and disclosed, for CEQA compliance purposes, that this impact may be potentially significant impact and unavoidable.

The FED concluded it was extremely unlikely the program would result in increases in localized air impacts due to facilities in some areas increasing their operations (because of the trading allowed under the program). The Co-Pollutant Emissions Assessment (Appendix P to the Staff Report prepared for the rulemaking) concluded that even if such potential emissions increases did occur, such increases would be small within the context of the larger cumulative emissions reductions that would occur as a result of California's extensive emissions control program. However, the FED acknowledged that, because specific actions by covered entities cannot be determined in the program level environmental analysis, specific adverse localized emissions impacts could not be ruled out. Because the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects, and the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and disclosed, for CEQA compliance purposes, that this impact is potentially significant and unavoidable. The Board adopted the Adaptive Management Plan as an integral part of implementation of the program to address any such unanticipated, unintended and ongoing adverse localized air quality impacts.

Implementation of projects under the ODS Offset Protocol and the Livestock Offset Protocol would produce incidental emissions from transportation and construction which would be less than significant. Both of these protocols reduce GHG emissions, considered a beneficial effect.

Implementation of projects implemented under the Urban Forest Offset Protocol would produce incidental emissions that would be less than significant. Implementation of projects under the Forest Offset Protocol would not alter the level of forest activities, and therefore, would have a less than significant air quality impact.

Impacts related to CCS are described above under the Energy Sector.

4. Biological Resources

a) Energy Sector

Impact 4.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Although it is reasonably foreseeable that construction activities could occur, there is uncertainty as to the exact location of any new facilities or modification of existing facilities. Construction could require disturbance of undeveloped areas, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways.

The future development of renewable energy projects could affect biological resources in various ways, depending on the types of technology. For instance, operation of wind farms could result in the direct mortality of birds and bats through collision with rotating turbines or transmission lines or trauma from turbulence or pressure changes surrounding the moving turbines. Development of solar energy development is considered to have direct effects and habitat loss for desert tortoise and other sensitive desert wildlife. In addition, human activities in previously undeveloped areas potentially provide food or other attractants in the form of trash, litter, or water, which draw unnaturally high numbers of predators such as the common raven, kit fox, and coyote. Depending on the size and location of utility-scale renewable projects, construction and operation could reduce the ability of terrestrial wildlife populations to move unimpeded through an area. In addition, impacts to aquatic habitat, such as diversion of stream flows, could impede movement of native fishes and aquatic wildlife, conflict with adopted habitat conservation plans, natural communities conservation plans, and other conservation plans or other policies to protect natural resources.

These activities would have the potential to adversely affect biological resources (e.g., species, habitat) that may reside or be present in those areas. Because there are

biological species that occur, or even thrive, in developed settings, resources could also be adversely affected by construction within disturbed areas at existing manufacturing facilities.

The biological resources that could be affected by the construction and operation of new or modified manufacturing plants or renewable energy projects would depend on the specific location of any necessary construction and its environmental setting. Adverse impacts could include modifications to existing habitat; including removal, degradation, and fragmentation of riparian systems, wetlands, or other sensitive natural wildlife habitat and plant communities; interference with wildlife movement or wildlife nursery sites; loss of special-status species; and/or conflicts with the provisions of adopted habitat conservation plans, natural community conservation plans, or other conservation plans or policies to protect natural resources.

Consequently, short-term construction-related and long-term operational impacts to biological resources associated with the Energy Sector would be potentially significant.

This impact on biological resources associated with the Energy Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of biological resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to biological resources include:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance response to new regulations would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all feasible mitigation identified in the environmental document to reduce or substantially lessen the potentially significant impacts to biological resources. The definition of actions required to mitigate potentially significant

biological impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.

- Retain a qualified biologist to prepare a biological inventory of site resources prior to ground disturbance or construction. If protected species or their habitats are present, comply with applicable federal and State endangered species acts and regulations. Construction and operational planning will require that important fish or wildlife movement corridors or nursery sites are not impeded by project activities.
- Retain a qualified biologist to prepare a wetland survey of onsite resources. This survey shall be used to establish setbacks and prohibit disturbance of riparian habitats, streams, intermittent and ephemeral drainages, and other wetlands. Wetland delineation is required by Section 3030(d) of the Clean Water Act and is administered by the U.S. Army Corps of Engineers.
- Prohibit construction activities during the rainy season with requirements for seasonal weatherization and implementation of erosion prevention practices.
- Prohibit construction activities in the vicinity of raptor nests during nesting season or establish protective buffers and provide monitoring, as needed, to address project activities that could cause an active nest to fail.
- Prepare site design and development plans that avoid or minimize disturbance of habitat and wildlife resources, and prevent stormwater discharge that could contribute to sedimentation and degradation of local waterways. Depending on disturbance size and location, a National Pollution Discharge Elimination System (NPDES) construction permit may be required from the California State Water Resources Control Board.
- Prepare spill prevention and emergency response plans, and hazardous waste disposal plans as appropriate to protect against the inadvertent release of potentially toxic materials.
- Plant replacement trees and establish permanent protection suitable habitat at ratios considered acceptable to comply with “no net loss” requirements.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and because the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA

compliance purposes, that short-term construction-related and long-term operational impacts to biological resources resulting from development of new facilities or modification of existing facilities associated with Energy Sector actions would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 4.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improving vehicle efficiency and develop zero emission technologies; (2) reducing the carbon content of fuels and provide market support to encourage the use of these fuels; (3) planning for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improving the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts to biological resources related to the manufacturing of these technologies would be of similar type and magnitude as those discussed under Impact 4.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to biological resources associated with the Transportation Sector would be potentially significant.

This impact on biological resources associated with the Transportation Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.b: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to biological resources associated with the Transportation Sector would be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 4.c

Short-Term Construction-Related Impacts

Reasonably foreseeable compliance responses associated with the recommended actions in the Agriculture Sector would incentivize onsite management practices and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities and not result in substantial conversion of habitat.

Thus, short-term construction-related impacts on biological resources associated with the Agriculture Sector would be **less than significant**.

Long-Term Operational Impacts

Compliance responses associated with the recommended actions in the Agriculture Sector would incentivize efficient and precise use of nitrogen fertilizers and irrigation water, conservation tillage practices, and land use planning strategies that protect croplands, forests, rangelands, and wetlands. These programs would reduce the over-application of nitrogen fertilizers which, combined with over-irrigation, can lead to nitrogen contamination and oxygen depletion of adjacent aquatic habitats. Implementation of reduced tillage and conservation tillage programs would reduce sediment transport into surface waters which would also protect aquatic habitats. Finally, preventing the conversion of croplands, forests, rangelands, and wetlands to developed uses would reduce habitat loss from both common and special status species.

Overall, implementation of recommended actions in the Agriculture Sector would increase conservation of biological resources, resulting in a **beneficial** long-term operational impact.

d) Water

Impact 4.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Wetlands or drainages could be affected by pipeline trenching activities, bore and jack installation under stream, and other construction activities. These could further affect riparian habitat, and result in the removal or disturbance of riparian vegetation, and alteration of bed and banks of drainage due to trenching.

In addition, operation of facilities associated with modifications to an existing water management strategy could affect discharge rates into stream and from wastewater treatment plants. Depending on the location of programs, aquatic and terrestrial species that rely upon water features could be adversely affected (e.g., fish, migratory birds).

Although it is reasonably foreseeable that construction and operational activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Short-term construction-related and long-term operational impacts to biological resources associated with the Water Sector could be potentially significant.

This impact on biological resources associated with the Water Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.d: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to biological resources resulting from the development new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 4.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the recommended actions in the Waste Management Sector could require construction and operation of new, or expansion of existing, composting and anaerobic digestion facilities.

Impacts to biological resources resulting from the Waste Management Sector recommendations would be of similar type and magnitude as those discussed under Impact 4.a under the Energy Sector, and would be potentially significant.

Short-term construction-related and long-term operational impacts to biological resources associated with the Waste Management Sector would be potentially significant.

This impact on biological resources associated with the Water Management Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.e: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address

project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to biological resources associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 4.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

However, in addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. This could be accomplished through increased use of biomass facilities, dairy digesters, and biogas facilities at wastewater treatment plants and landfills. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them. Impacts would be of similar type and magnitude as discussed under Impact 4.a under the Energy Sector.

The types of short-term construction-related impacts to biological resources associated with the Natural and Working Lands Sector would potentially significant.

This impact on biological resources associated with the Natural and Working Lands Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.f: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts to biological resources associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

As described above, compliance responses associated with the Energy Sector could include the operation of biomass facilities. The fuel source for biomass facilities is generally woody biomass acquired primarily from hazardous fuel removal, forest thinning, and other forest management activities. Removal of woody biomass from the surrounding forests could modify habitat for common and special-status species, degrade sensitive habitats, and/or result in fill of jurisdictional waters of the United States. However, forest projects that would generate the woody biomass are separate projects that would be subject to separate environmental review and permitting. The generation of woody biomass would occur regardless of the proposed biomass project. Disposal of the woody biomass at these types of facilities in lieu of other disposal methods such pile burning would not have a substantial effect on biological resources.

Therefore, long-term operational impacts on biological resources, associated with the Natural and Working Lands Sector, are considered to be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 4.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

As described above the recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely

that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction and operational impacts to biological resources would be of similar type and magnitude as those discussed under Impact 4.a under the Energy Sector.

Short-term construction-related and long-term operational impacts on biological resources, associated with the Short-Lived Climate Pollutants Sector would be potentially significant.

This impact on biological resources associated with the Short-Lived Climate Pollutants Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.g: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to biological resources associated with the Short-Lived Climate Pollutants Sector would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 4.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions for Green Buildings include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Reasonably foreseeable compliance responses include increased demand for renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and funding of carbon offset technologies, including solar PV or wind turbine farms, which could require new or expanded manufacturing facilities or renewable energy projects. These activities could result in ground disturbance and habitat loss as well as other impacts similar in type and magnitude to those discussed under Impact 4.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to biological resources associated with Green Buildings would be potentially significant.

This impact on biological resources associated with Green Buildings could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 4.h: Implement Mitigation Measure 4.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to biological resources associated with Green Buildings would be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 4.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involve construction, grading and trenching which have the potential to adversely impact any protected biological resources that might exist at those locations. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting

in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact may be potentially significant and unavoidable.

Implementation of projects under the ODS Offset Protocol would not include activities that potentially impact biological resources. Implementation of projects under the Livestock Offset Protocol would include the construction of digesters at or adjacent to existing livestock operations where natural habitats are expected to be absent or limited. As such, the Livestock Offset Protocol would result in less than significant impacts to biological resources. Implementation of projects under the Urban Forest Offset Protocol recognizes tree improvement projects in urban settings, and as such would not be expected to significantly affect biological resources. Implementation of projects under the Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Reforestation projects conducted under the Forest Offset Protocol could change existing habitat and disrupt wildlife. The FED identified recognized measures that exist to reduce this potentially significant impact but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact may be potentially significant and unavoidable. The Board adopted the Adaptive Management Plan as an integral part of implementation of the program to reduce the risk of unanticipated, unintended and ongoing adverse impacts to biological resources due to forestry projects under the Forest Offset Protocol.

Impacts related to CCS are described above under the Energy Sector.

5. Cultural Resources

Cultural resource impacts are inherently construction-related and, thus, long-term operational impacts are not discussed below.

a) Energy Sector

Impact 5.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and

microgrid systems, and oil and gas production, processing, storage, distribution, and transmission system upgrades. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Construction activities could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Demolition of existing structures may also occur before the construction of new buildings and structures. The cultural resources that could potentially be affected by ground disturbance activities could include, but are not limited to, prehistoric and historical archaeological sites, paleontological resources, historic buildings, structures, or archaeological sites associated with agriculture and mining, and heritage landscapes. Properties important to Native American communities and other ethnic groups, including tangible properties possessing intangible traditional cultural values, also may exist. Historic buildings and structures may also be adversely affected by demolition-related activities. Such resources may occur individually, in groupings of modest size, or in districts. Because culturally sensitive resources can also be located in developed settings, historic, archeological, and paleontological resources, and places important to Native American communities, could also be adversely affected by construction of new facilities.

Thus, short-term construction-related impacts to cultural resources associated with the Energy Sector could be potentially significant.

This impact associated with the Energy Sector could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.a

The Regulatory Setting in Attachment 2 includes, but is not limited to, applicable laws and regulations that provide protection of cultural resources. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to cultural resources include:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance responses to new regulations would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant cultural impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
- Retain the services of cultural resources specialists with training and background that conforms to the U.S. Secretary of Interior's Professional Qualifications Standards, as published in Title 36, Code of Federal Regulations, part 61 (36 CFR Part 61).
- Seek guidance from the State and federal lead agencies, as appropriate, for coordination of Nation-to-Nation consultations with the Native American Tribes.
- Consult with lead agencies early in the planning process to identify the potential presence of cultural properties. The agencies will provide the project developers with specific instruction on policies for compliance with the various laws and regulations governing cultural resources management, including coordination with regulatory agencies and Native American Tribes.
- Define the area of potential effect (APE) for each project, which is the area within which project construction and operation may directly or indirectly cause alterations in the character or use of historic properties. The APE should include a reasonable construction buffer zone and laydown areas, access roads, and borrow areas, as well as a reasonable assessment of areas subject to effects from visual, auditory, or atmospheric impacts, or impacts from increased access.
- Retain the services of a paleontological resources specialist with training and background that conforms with the minimum qualifications for a vertebrate paleontologist as described in Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontologic Resources: Standard Procedures (Society of Vertebrate Paleontology 1995).
- Conduct initial scoping assessments to determine whether proposed construction activities would disturb formations that may contain important paleontological resources. Whenever possible potential impacts to paleontological resources should be avoided by moving the site of construction or removing or reducing the need for surface disturbance. The scoping assessment should be conducted by the qualified paleontological resources specialist in accordance with applicable agency requirements.

- The project proponent's qualified paleontological resources specialist would determine whether paleontological resources would likely be disturbed in a project area on the basis of the sedimentary context of the area and a records search for past paleontological finds in the area. The assessment may suggest areas of high known potential for containing resources. If the assessment is inconclusive a surface survey is recommended to determine the fossiliferous potential and extent of the pertinent sedimentary units within the project site. If the site contains areas of high potential for significant paleontological resources and avoidance is not possible, prepare a paleontological resources management and mitigation plan that addresses the following steps:
    - a preliminary survey (if not conducted earlier) and surface salvage prior to construction;
    - physical and administrative protective measures and protocols such as halting work, to be implemented in the event of fossil discoveries;
    - monitoring and salvage during excavation;
    - specimen preparation;
    - identification, cataloging, curation and storage; and
    - a final report of the findings and their significance.

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with Energy Sector actions could be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 5.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could

require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5.a under the Energy Sector.

Short-term construction-related impacts on cultural resources associated with the Transportation Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.b: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with the Transportation Sector could be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 5.c

Short-Term Construction-Related Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands. Modification of soil, irrigation, and fertilization

practices would occur on existing disturbed lands, and would therefore not substantially increase the potential to affect historic, archeological, and paleontological resources, and places important to Native American communities.

Therefore, compliance responses under the Agriculture Sector would result in a **less-than-significant** short-term construction-related impacts on cultural resources.

d) Water

Impact 5.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities. The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5.a for the Energy Sector.

Short-term construction-related impacts on cultural resources associated with the Water Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.d: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with the Water Sector could be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 5.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5.a under the Energy Sector.

Short-term construction-related impacts on cultural resources associated with the Waste Management Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.e: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related

impact regarding cultural resources associated with the Waste Management Sector could be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 5.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs. In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations with appropriate zoning.

The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5.a under the Energy Sector.

Short-term construction-related impacts on cultural resources associated with the Natural and Working Land Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.f: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with the Natural and Working Lands Sector could be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 5.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5.a under the Energy Sector.

Short-term construction-related impacts on cultural resources associated with the Short-Lived Climate Pollutant Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.g: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with the Short-Lived Climate Pollutant Sector would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 5.h

Short-Term Construction-Related Impacts

The Proposed Update includes recommended actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

New construction activities, including buildings, and renewable energy supply installations could be placed on land that is currently used for agricultural purposes.

The types of construction-related impacts on cultural resources would be of similar type and magnitude as those discussed under Impact 5a under the Energy Sector.

A short-term construction-related impacts on cultural resources associated with Green Buildings would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 5.h: Implement Mitigation Measure 5.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding cultural resources associated with Green Buildings could be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 5.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involve construction, grading and trenching which have the potential to adversely impact any cultural resources that might exist at those locations. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact may be potentially significant and unavoidable.

Implementation of projects under the ODS Offset Protocol would not include activities that potentially impact cultural resources. Implementation of projects under the Livestock Offset Protocol would include the construction of digesters at or adjacent to existing livestock operations where cultural or historic features could exist. Similarly, implementation of projects under the Urban Forest Offset Protocol includes projects in urban settings where cultural and historic resources could exist. The FED identified recognized mitigation measures that exist to reduce these potential impacts, but the authority to require project-specific mitigation lies with local permitting agencies and not ARB. Consequently, the FED conservatively identified these impacts as significant and unavoidable. Implementation of projects under the Forest Offset Protocol could change the type of forest projects that are undertaken, but would not alter the overall level of forest activities, and as such would not increase potential impacts to cultural resources. This impact would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

6. Energy Demand

a) Energy Sector

Impact 6.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Temporary increases in energy demand associated with construction of new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand, associated with the Energy Sector, would be **less than significant**.

Long-term Operational Impacts

The reasonably foreseeable compliance responses associated with the Energy Sector generally orient the State towards renewable energy sources; distributed generation; reduced future energy demand through building design strategies and features; and increased system efficiency through smart-grid and microgrid technologies, and demand-response efforts. These strategies could create an energy generation, storage, and distribution system that relies upon renewable and distributed sources to a greater extent than under existing conditions.

Large scale renewable energy generation projects (e.g., solar PV farms) and CHP systems could affect energy sources and efficiencies - but not necessarily energy demand – by shifting reliance away from more conventional fossil-based fuels and power plants. Likewise, improved energy storage systems, or more efficient distribution systems, would not necessarily reduce demand. However, various emerging

technologies related to smart grid implementation and other demand response actions would support the operational reliability of renewable and distributed energy resources. Reductions in energy demand could be facilitated through modification of new and existing homes and businesses to operate with zero net energy efficiencies, and by increasing the deployment of customer-oriented energy demand response or conservation programs.

Implementation of the recommended actions in the Proposed Update could encourage the development of additional or new energy production, storage, and transmission systems. Such development could gradually reduce the State's reliance on conventional fossil-based fuels, such as natural gas, and increase demand for a more diversified assortment of renewable and conventional fuels.

Thus, long-term operational energy demand impacts associated with the Energy Sector would be **beneficial**.

b) Transportation Sector

Impact 6.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improving vehicle efficiency and develop zero emission technologies; (2) reducing the carbon content of fuels and provide market support to encourage the use of these fuels; (3) planning for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improving the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Temporary increases in energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand, associated with the Transportation Sector, would be **less than significant**.

Long-Term Operational Impacts

The recommended actions associated with the Transportation Sector are aimed to increase the number of light-duty and heavy-duty vehicles that run on zero-emission technologies – hybrids, battery electric vehicles, and fuel cell vehicles, and encourage alternative transportation, such as walking, biking, or public transit. In addition, freight systems could be modified to include near-dock rail, zero-emission container transportation, and zero-emission truck corridors. In terms of energy demand, the Transportation Sector recommendations could shift from conventional vehicles toward battery electric, fuel cell, and hybrid technologies.

Because conventional, hybrid, and electric vehicles require different types of fuel (i.e., petroleum-based fuels or electricity), it is helpful to consider energy demand on a lifecycle basis. A vehicle's energy lifecycle consists of the energy needed to manufacture and transport vehicle parts, use of the vehicle over its lifetime, and disposal at end-of-useable life. A report prepared for ARB considered these factors while evaluating light-duty conventional, battery electric, and hybrid vehicles. The greatest energy requirement occurs during the "use" phase, in which either petroleum fuel or electricity is needed to power the vehicle. This report found that a typical conventional light-duty vehicle would require approximately 860,000 megajoules (MJ); a hybrid would require approximately 560,000 MJ; and a battery electric vehicle would require approximately 510,000 MJ (ARB 2012a). Similarly, fuel production has been found to be lower for electric freight systems than diesel-fueled trucks (California Cleaner Freight Coalition 2013).

Reasonably foreseeable compliance measures associated with the Transportation Sector would reduce overall energy demand, and be considered a **beneficial** long-term operational impact.

Potential effects of electrical vehicle supply equipment on electricity distributions systems are discussed in Section 18, Utilities and Service Systems.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 6.c

Short-Term Construction-Related Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Overall, implementation of recommendations associated with the Agriculture Sector would increase conservation of agriculture and forest resources, thereby decreasing urban sprawl and the amount of energy needed to supply future

developments. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand, associated with the Agriculture Sector, would be **less than significant**.

Long-Term Operational Impacts

Plans to use digester biogas in natural gas pipelines and bioenergy to supply the electricity grid would reduce reliance on the existing energy demand from power plants.

In addition, reducing water usage in the Agriculture Sector would result in reduced electricity demand associating with moving and treating that water.

Therefore, the recommendations in the Agriculture Sector could result in a **beneficial** long-term operational impact to energy demand.

d) Water Sector

Impact 6.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on energy demand would be of similar type and magnitude as those discussed under Impact 6.a for the Energy Sector.

Short-term construction-related impacts on energy demand associated with the Water Sector would be **less than significant**.

Long-Term Operational Impacts

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector could include increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur.

Water systems require energy to pump, treat, transport, heat, cool, and recycle water. In general, the greatest energy demand is associated with water treatment plants, the number of which could be increased under the Water Sector. The energy requirements associated with water treatment depend primarily on the characteristics of the raw water, plant size, treatment process, and the distance and elevation of the treatment plant in relation to water sources and water distribution systems.

For wastewater treatment, the characteristics of the influent and the level of treatment (primary, secondary or tertiary) are principal drivers of energy consumption. Recycled water is generally secondary- or tertiary-treated wastewater that is used for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, or replenishing a ground water basin (referred to as ground water recharge). Wastewater treatment can be tailored to meet the water quality requirements of a specific planned reuse.

Because of the varying energy demands associated with treatment, displacing sources such as surface water or groundwater with recycled water could reduce energy demand, as exemplified as follows.

- Use of local recycled water to recharge depleted groundwater aquifers would decrease the amount of energy-intensive seawater desalination and surface water supplies.
- When recycled water is distributed to local end users for landscape irrigation, substantial energy savings result from displacing the energy intensity of the highest marginal water source and avoiding the energy used to treat the water unnecessarily to potable water standards.
- Because recycled water is often a by-product of existing secondary and tertiary wastewater treatment processes, it is the least energy-intensive source in the state’s water supply.
- Wastewater from urban uses is collected, treated, and discharged back to the environment, where it becomes a source for someone else. Recycling water back

into a water supply system would reduce the need to pump, treat, and distribute water multiple times.

Thus, while there could be a potential increase in energy demand associated with the operation of recycled water treatment plants, and conveyance of water, it would be less energy demand than pumping, treatment, and distribution of raw water supplies.

Long-term operational impacts on energy demand associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 6.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and development of anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

Temporary increases in energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand, associated with the Waste Management Sector, would be **less than significant**.

Long-Term Operational Impacts

The use of waste-to-energy facilities would generate energy. This would not decrease overall energy demand but could decrease demand from fossil-based energy sources. There is an energy demand associated with recycling materials. However, these recycling materials would reduce the need to extract and refine natural resources, thereby requiring less energy (EPA 2013). Further development of programs between ARB, CalRecycle, and other State agencies could require that more energy efficient policies are created.

Thus, long-term operational energy demand impacts associated with the Waste Management Sector would be **beneficial**.

f) Natural and Working Lands Sector

Impact 6.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommended actions under the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations with appropriate zoning.

Temporary increases in energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand, associated with the Natural and Working Lands Sector, would be **less than significant**.

Long-Term Operational Impacts

The Natural and Working Lands Sector recommendations would increase vegetation in urban environments and encourage conservation of rural areas. These actions would result in reduced energy through reduced urban heat island effects (e.g., shading provides cooling for buildings), more efficient land use planning (reducing potential urban boundaries), and improving water quality that may reduce treatment requirements. Furthermore, reasonably foreseeable compliance responses include

operation of biomass facilities. While this may not result in decreased energy demand, it could shift supply sources away from fossil-based sources.

Overall, conservation and land use planning recommendations associated with the Natural and Working Lands Sector would result in a **beneficial** long-term operational impact on energy demand.

g) Short-Lived Climate Pollutants Sector

Impact 6.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in construction and operation of new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

Energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Replacement compounds could be required for various items, including commercial refrigeration and air conditioning, transport refrigeration, aerosol propellant metered dose inhalers, solvents, fire suppressants, and structural pesticide fumigants. New low-GWP compounds are likely to be phased in, as refrigerator units and other devices reach the end of their useful lives, and existing stocks become depleted. Production of low-GWP compounds would take the place of production of the existing high-GWP compounds, and would not be expected to experience a substantial and long-term increase in demand.

Short-term construction-related impacts and long-term operational impacts on energy demand associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 6.h

Short-Term Construction-Related Impacts

The Proposed Update includes actions in the Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance

responses associated with Green Buildings would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms.

Temporary increases in energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude.

Short-term construction-related impacts on energy demand associated with Green Buildings would be **less than significant**.

Long-Term Operational Impacts

Compliance responses associated with Green Buildings would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. These building components could be incorporated into new structures or added as part of building remodeling projects.

These types of building design strategies associated with Green Buildings would reduce energy demand, and result in **beneficial** long-term operational impacts.

i) Cap-and-Trade Regulation

Impact 6.i

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols , the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to

lower intensity carbon fuels, and implementing maintenance and process changes. These actions will reduce overall energy demand and are considered beneficial effects.

Projects implemented under the compliance offset protocols would not increase energy demand, and as such pose no impacts or less than significant impacts to energy demand.

Impacts related to CCS are described above under the Energy Sector.

7. Geology and Soils

a) Energy Sector

Impact 7.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Although it is reasonably foreseeable that construction and operational activities could occur, there is uncertainty as to the exact location of any new facilities or modification of existing facilities. Construction activities could require disturbance of undeveloped areas, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Additional disturbance could result from the increased mineral ore extraction activities which would provide raw materials to these manufacturing facilities and energy projects. These activities would have the potential to adversely affect soil and geologic resources in construction or mineral ore extraction areas.

New facilities could be located in a variety of geologic, soil, and slope conditions with varying amounts of vegetation that would be susceptible to soil compaction, soil erosion and loss of topsoil during construction. The level of susceptibility varies by location. However, the specific design details, siting locations, and soil compaction and erosion hazards for particular manufacturing facilities are not known at this time and would be analyzed on a site-specific basis at the project level. Potential impacts from the mineral extraction process could also include loss of soil productivity resulting from compaction,

erosion, and loss of topsoil; potential soil contamination from mining activities and mineral processing; and fracture, removal, and exposure of geologic materials.

Short-term construction-related impacts to geology and soil resources associated with the Energy Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of geology and soils. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize impacts to geology and soils include:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance responses to new regulations would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts on soil erosion and the loss of topsoil. The definition of actions required to mitigate potentially significant geology and soil impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
    - Prior to the issuance of any development permits, proponents of new or modified facilities or infrastructure would prepare a geotechnical investigation/study, which would include an evaluation of the depth to the water table, liquefaction potential, physical properties of subsurface soils including shrink-swell potential (expansion), soil resistivity, slope stability, mineral resources and the presence of hazardous materials.
    - Proponents of new or modified facilities or infrastructure would provide a complete site grading plan, and drainage, erosion, and sediment

control plan with applications to applicable lead agencies. Proponents would avoid locating facilities on steep slopes, in alluvial fans and other areas prone to landslides or flash floods, or with gullies or washes, as much as possible.

- Disturbed areas outside of the permanent construction footprint would be stabilized or restored using techniques such as soil loosening, topsoil replacement, revegetation, and surface protection (i.e. mulching).

Mineral extraction and mining activities that could occur outside of California would be required to comply with the natural resource protection and land reclamation requirements of the appropriate state and federal land managers. The strongest protections for soil and geologic resources are found in the Bureau of Land Management (BLM) and US Forest Service mining permit conditions. All projects on federal lands would be required to provide disclose potential impacts as required by the National Environmental Policy Act. On BLM lands, all mining operations are subject to monitoring by the BLM to protect against unnecessary or undue degradation, and that all operators are responsible for fully reclaiming the area of their claim. Reclamation requires restoration of disturbed areas to stable, self-sustaining, and productive conditions which comply with the land-use plan for the area (EPA 1994). The US Forest Service enforces similar mining reclamation standards for the land it manages. Reclamation requirements for mining operations on private lands vary from state to state.

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts to geology and soils associated with the Energy Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Recommended actions associated with the Energy Sector include methodology to quantify CCS projects. Geological sequestration of CO_2 is a technology that injects and stores anthropogenic CO_2 produced by various industries and electric generation facilities in porous and permeable subsurface rock units, thereby preventing the release of the CO_2 into the atmosphere where it may contribute to global warming. Few large-scale CO_2 geologic sequestration projects exist today and more research is needed to be to better understand the geologic controls on subsurface rock storage capacities, the geologic and environmental hazards, and economic feasibility associated with CO_2 geologic sequestration.

Most seismic events result from the natural geologic processes reshaping the earth. However, human activities, such as primary or secondary oil recovery, solution mining, explosions, large impoundments of water, geothermal stimulation, or other fluid injection have also been demonstrated to increase the risk of seismic events by increasing subsurface pressure. When this happens, portions of the subsurface can be induced to move, potentially generating seismic events.

Long-term operational impacts to geology and soil associated with the Energy Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts.

Permits and/or agreements to reduce potential geology and soils impacts could include, but are not limited to, several classes of Underground Injection Control (UIC) permits administered pursuant to the Safe Drinking Water Act (SDWA) at the federal and State and levels. The US EPA issues Class VI permits under these regulations, which apply to injections wells that are drilled for the sole purpose of CO_2 injection in an underground formation as part of a CCS project, without any other intended purpose. The California Division of Oil, Gas and Geothermal Resources (DOGGR) issues Class II permits under regulatory authority granted by US EPA pursuant to UIC regulations. Class II permits apply to injection wells created for the purpose of extracting oil and gas, including injection wells used for enhanced oil recovery (EOR) methods that could also be used for the purpose of CO_2 sequestration as part of a CCS project.

To obtain these permits, the project proponent would be required to conduct various evaluations, such as engineering studies, geologic study, and injection plans. Requirements for these permits are likely to include: isopach maps, cross sections, and a representative electric log that identifies all geologic units, formations, freshwater aquifers, and oil or gas zones. Because these permits would address inspection, enforcement, mechanical integrity testing, plugging and abandonment oversight, data management, and public outreach, this impact could be reduced to a less than significant level.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA

compliance purposes, that short-term construction and long-term operational impacts to soil and geologic associated with the Energy Sector would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 7.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions associated with the Transportation Sector could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities. The types of impacts to soil and geologic resources related to the manufacturing of these technologies would be of similar type and magnitude as those discussed under Impact 7.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to geology and soils associated with the Transportation Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.b: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soil impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to soil and geologic associated with the Transportation Sector would be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 7.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize efficient and precise use of nitrogen fertilizers and irrigation water, conservation tillage practices, and land use planning strategies that protect croplands, forests, rangelands, and wetlands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial effects on geology and soils.

Programs could reduce the over-application of nitrogen fertilizers, which results in the oxidation of soil organic matter, the release of sequestered carbon, and loss of soil structure (Kahn *et al.* 2007). Incentives for precision farming practices could also reduce the amount of farm equipment traffic and thereby reduce compaction of agricultural soils. Implementation of reduced tillage and conservation tillage programs would reduce soil erosion due to wind and surface runoff.

Overall, implementation of recommended actions associated with the Agriculture Sector would result in **less-than-significant** short-term construction and long-term operational impacts to soil and geological resources.

d) Water Sector

Impact 7.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction and operational activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts on geology and soils would be of similar type and magnitude as those discussed under Impact 7.a for the Energy Sector.

Short-term construction-related and long-term operational impacts on soils and geological resources associated with the Water Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.d: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to soil and geologic resources resulting from the development new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 7.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction and operation of new, or expansion of existing, composting and anaerobic digestion facilities.

Impacts to soil and geologic resources resulting from these recommendations would be of similar type and magnitude as those discussed under Impact 7.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to soil and geologic resources associated with the Waste Management Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.e: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to soil and geologic associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 7.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related impacts to soil and geological resources would be of similar type and magnitude as those discussed under Impact 7.a under the Energy Sector. In addition to construction related impacts, removal of biomass materials from forest lands could involve the use of heavy equipment timber harvest practices that result in ground disturbance, compaction, and increased erosion.

Short-term construction and long-term operations-related impacts on Geology and Soils associated with the Natural and Working Lands Sector could be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.f: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to geology and soils associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 7.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions in the Short-Lived Climate Pollutants sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriate zoned to accommodate them.

The types of impacts to soil and geological resources would be of similar type and magnitude as those discussed under Impact 7.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to soils and geologic resources associated with the Short-Lived Climate Pollutants Sector would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 7.g: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to geology and soils associated with the Short-Lived Climate Pollutants Sector would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 7.h

Short-Term Construction-Related Impacts and Long-Term Operational

The Proposed Update includes development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. These programs would drive demand for renewable energy supplies (e.g., solar, wind turbines, waste digesters), fuel cells, and funding of carbon offset technologies, including solar PV or wind turbine farms, which could require new or expanded manufacturing facilities or renewable energy projects.

These activities would result in impacts to soil and geologic resources similar in type and magnitude to those discussed under Impact 7.a under the Energy Sector.

Impacts to Geology and Soils associated with Green Buildings would be potentially significant.

The impacts to soil and geologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 7.h: Implement Mitigation Measure 7.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant geology and soils impacts. Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to geology and soils associated with Green Buildings would be **potentially significant and unavoidable.**

i) Cap-and-Trade Regulation

Impact 7.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involve construction, grading and trenching which have the potential to result in adverse soil erosion, dust generation, and sedimentation of local waterways. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact as potentially significant and unavoidable.

Implementation of projects under the ODS Offset Protocol would pose no significant impacts on geology, soils and mineral resources. Implementation of projects under the

Livestock Offset Protocol would include the construction of digesters that would be subject to regulations considered sufficient to mitigate potential impact to geology, soils and mineral resources to a less than significant level. Implementation of projects under the Urban Forest Offset Protocol would result in only minor soil disturbance and would not be expected to adversely impact geology, soils or mineral resources. This impact would be less than significant. Implementation of projects under the Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Because the overall level of forest activities would not change, this impact would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

8. Greenhouse Gases

a) Energy Sector

Impact 8.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location of any new facilities or the reconstruction or modification of existing facilities. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. Specific, project-related construction activities would result in increased generation of GHG emissions associated with the use of heavy-duty off-road equipment, materials transport, and worker commutes. Construction-related GHG emissions are expected to be short-term and limited in amount.

Local agencies, such as air pollution control districts, are generally charged with determining acceptable thresholds of GHG emissions, measured in metric tons of carbon dioxide equivalent per year (MT CO_2e/year). Quantification of short-term construction-related GHG emissions is generally based on a combination of methods,

including the use of exhaust emission rates from emissions models, such as OFFROAD 2007 and EMFAC 2011. These models require consideration of assumptions, including construction timelines and energy demands (e.g., fuel and electricity). However, a majority of local agencies (e.g., air pollution control districts) do not recommend or require the quantification of short-term construction-generated GHGs for typical construction projects because these only occur for a finite period of time (e.g., during periods of construction) that is typically much shorter than the operational phase. Thus, agencies generally recommended that GHG analyses focus on operational phase emissions, as discussed below, unless the project is of a unique nature requiring atypical (e.g., large scale, long-term) activity levels (e.g., construction of a new dam or levee) for which quantification and consideration (e.g., amortization of construction emissions over the lifetime of the project) may be recommended.

Thus, short-term construction-related GHG emissions impacts associated with the Energy Sector would be **less than significant**.

Long-Term Operational Impacts

The reasonably foreseeable compliance responses associated with the Energy Sector are aimed to orient the State toward renewable energy sources, reduce future energy demands through building design strategies and features, and increase system efficiency through smart-grid and microgrid technologies, and demand-response efforts. These strategies could create an energy generation, storage, and distribution system that could rely upon renewable sources to a greater extent than under the existing conditions. Large scale renewable energy generation projects (e.g., solar PV farms) and CHP systems could affect energy sources - but not necessarily energy demand – by shifting reliance of energy sources from fossil-based fuels. Likewise, energy storage devices, or microgrid, actions would not necessarily reduce demands. However, various emerging technologies related to smart grid implementation and other demand response actions would allow an increase in reliability of renewable energy sources, because monitoring efforts could be used to determine when to store energy generated from renewable sources. In addition, reductions in energy demand could be facilitated through modification of existing structure to be ZNE homes and businesses.

Combustion of fossil fuels, such as coal, oil, and natural gas, to produce energy, releases GHG emissions including CO_2 and CH_4. By increasing the share of total electricity generated from wind, solar, and other renewable sources, fuel combustion could be substantially decreased. Furthermore, installation of CCS projects would allow for CO_2 sequestration resulting from industrial emitters. Geological sequestration of CO_2 is a technology that injects and stores anthropogenic CO_2 produced by various industries and electric generation facilities in porous and permeable subsurface rock units, thereby preventing the release of the CO_2 into the atmosphere where it may contribute to global warming. Thus, by orienting the State's energy supply toward renewable sources through production, storage, monitoring, and energy-efficient building construction and reducing the amount of CO_2 that is released into the atmosphere, GHG emission could be reduced.

Long-term operational impacts on GHG emissions associated with the Energy Sector would be **beneficial**.

b) Transportation Sector

Impact 8.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improving vehicle efficiency and develop zero emission technologies; (2) reducing the carbon content of fuels and provide market support to encourage the use of these fuels; (3) planning for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improving the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Transportation Sector would be **less than significant**.

Long-Term Operational Impacts

The recommended actions associated with the Transportation Sector would increase the number of vehicles that run on zero-emission technologies – hybrids, battery electric vehicles, and fuel cell vehicles; and encourage the use of alternative modes of transportation, such as walking, biking, or public transit. All of these actions would reduce fossil fuel combustion, leading to a decrease in CO_2 emitted during vehicle operation. In addition, black carbon, a subset of PM emissions considered to be a short-lived climate pollutant, becomes distributed into the atmosphere through on-road vehicles.

As described above, in Impact 3.b, vehicles can be considered on a lifecycle basis, which includes manufacture and transport vehicle parts, use of the vehicle over its lifetime, and disposal at end-of-useable life. Comparisons of lifecycle CO_2 equivalents have indicated that the lowest emissions levels would be released by battery electric

vehicles, followed by hybrids, and finally conventional vehicles (ARB 2012a). Similarly, fuel production, and therefore associated GHG emissions from generation, has been found to be lower for electric freight systems than diesel-fueled trucks (California Cleaner Freight Coalition 2013).

Thus, reasonably foreseeable compliance responses associated with the Transportation Sector would result in a **beneficial** long-term operational impact on GHG emissions.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 8.c

Short-Term Construction-Related Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Overall, implementation of recommendations associated with the Agriculture Sector would increase conservation of agriculture and forest resources, thereby decreasing the amount of energy needed to supply future developments. As described in the Chapter IV of the Scoping Plan, the primary GHG emissions associated with agriculture include CH_4, CO_2, N_2O, and black carbon. Implementation of the recommended actions associated with the Agriculture Sector would target these emissions through fertilizer, manure, and soil management practices. In addition, reductions in water and fuel use would facilitate a decrease in fuel combustion.

The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Agriculture Sector would be **less than significant**.

Long-Term Operational Impacts

Replacing fossil fuels with biofuels—fuels produced from renewable organic material—has the potential to reduce some undesirable aspects of fossil fuel production and use, including GHG emissions. However, because many biofuel feedstocks require land, water, and other resources, research suggests that biofuel production may give rise to several undesirable effects. Depending on the feedstock and production process and time horizon of the analysis, biofuels can emit even more GHGs than some fossil fuels on an energy-equivalent basis (EPA 2014). However, because the Proposed Update would include research and coordination between State, local, and national conservation programs to reduce GHG emission reductions, the recommendations under the Agriculture Sector would result in reduced GHG emissions.

Thus, long-term operational GHG emissions impacts associated with the Agriculture Sector would be **beneficial**.

d) Water Sector

Impact 8.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a for the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Water Sector would be **less than significant**.

Long-Term Operational Impacts

Recommended actions associated with the Water Sector could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Compliance responses associated with the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could also include construction of water recycling and wastewater treatment facilities, which could emit CO_2. However, recommended actions associated with the Water Sector would also increase conservation of water resources, thereby reducing the amount of electricity needed for storage, conveyance, and treatment. While, the GHG emissions associated with this program are currently unknown, coordination between ARB, CEC, SWRCB, and other State agencies will require that the net GHG would result in a net decrease.

Thus, long-term operational GHG emissions impacts associated with the Water Sector would be **beneficial**.

e) Waste Management Sector

Impact 8.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling, and development of anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Waste Management Sector would be **less than significant**.

Long-Term Operational Impacts

Anaerobic digestion facilities emit CO_2 as a byproduct of combustion. However, this is not considered to be an increase because it is part of the Earth's natural carbon cycle. The plants and trees that make up the paper, food, and other biogenic waste remove CO_2 from the air while they are growing, which is returned to the air when this material is burned. In contrast, when fossil fuels are burned, they release CO_2 that has not been part of the Earth's atmosphere for a very long time (i.e., within a human time scale).

In addition, compared to landfilling, using organic material as feedstock for composting and anaerobic digestion can result in reductions of GHG emissions. The GHG emission reductions from these activities would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, and reduction in synthetic fertilizer and water usage. In addition, composted/digested organic materials can be used in beneficial

ways, some of which can further reduce GHG emissions, including decreased water use, increased soil carbon storage, decreased soil erosion, and decreased herbicide use.

Implementation of recommendations under the Waste Management Sector of the Proposed Update would reduce CH_4 emissions through installation of emission reductions devices, reductions in waste generation, and shifting waste to energy. Through determining the best use of recycling, examining ways to increase the use of collected wastes, and funding emission-reducing infrastructure, associated with the Waste Management Sector, GHG emissions would be reduced.

Thus, long-term operational GHG emissions impacts associated with the Waste Management Sector would be **beneficial**.

f) Natural and Working Lands Sector

Impact 8.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommended actions under the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning.

The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Natural and Working Lands Sector would be **less than significant**.

Long-Term Operational Impacts

The Natural and Working Lands Sector recommends development of biomass facilities. Biomass typically refers to a quantity of organic, plant-based material. Biomass material is formed through absorption of carbon (in the form of CO_2) from the atmosphere in the presence of energy supplied by the sun. At the end of its life, biomass material breaks down and releases carbon back into the atmosphere, either as CO_2 or CH_4, depending on the decomposition conditions. Aerobic decomposition of biomass occurs in the presence of oxygen, and is conducive to CO_2 formation. Anaerobic decomposition occurs in an oxygen-deprived environment in the presence of bacteria and predominantly results in CH_4 formation along with smaller quantities of CO_2 (CEC 2014). The types of biomass feed stock from the Natural and Working Lands Sector suitable for gasification or combustion largely consist of woody biomass. This is because leafy plant materials do not meet specifications for energy content (i.e., BTU content), high heat value (HV), moisture content, ash content, and chip size. Potential feedstock sources include residuals from forest fuels reduction and defensible space activities; timber harvest residuals including limbs, treetops, and unmerchantable logs generated as byproducts of commercial timber harvest activities; construction and demolition wood waste from building/remodeling activities; and agricultural waste (e.g., orchard clippings, aged-out trees).

Power plants that consume biomass feed stocks—either by direct combustion or via gasification—produce electricity that qualifies for the Renewable Electricity Standard (RES) if the biomass feed stock is considered renewable. While direct combustion or combustion of gasification-produced synthetic gas produces GHG emissions, biomass facilities are considered "carbon neutral" by some entities ~~virtue that~~ because the CO_2 emissions are already part of the carbon cycle. ~~For instance, t~~The Buena Vista Biomass plant in Amador County produced electricity using forest thinning slash, urban wood waste (i.e., construction and demolition wood from building activities), and woody agricultural waste (i.e., orchard prunings) (Amador County 2010:1-1). The Cabin Creek biomass facility proposed in eastern Placer County would consume timber harvest residuals including limbs, treetops, and unmerchantable logs generated as byproducts of commercial timber harvest activities; and residuals as a result of forest fuels reduction and defensible space activities (Placer County 2012:3-11). The proposed Sierra Pacific Cogeneration Power Project in Shasta County would use these feed stocks as well as residue from sawmill operations (Shasta County 2012:2.0-31). Producing electricity with woody biomass from forest thinning, timber harvest residuals, and agricultural waste is considered carbon neutral because these materials would otherwise be piled and burned, resulting in similar levels of GHG emissions. Use of urban wood waste is often ~~also~~ considered carbon neutral because this material would otherwise undergo some mix of aerobic and anaerobic decomposition from use as mulch in landscaping applications or as a soil amendment in a compost operation—also resulting in GHG emissions. While the feedstock for biomass power facilities ~~are~~ is considered to be "carbon neutral", ARB recognizes there is disagreement on the issue of "carbon neutrality." As such, the Natural Working Lands and Agriculture Sectors of the Update each include a recommendation that the environmental evaluation of both

small-scale and utility-scale biomass energy facilities include the potential life-cycle GHG flux impacts of biomass.

The operation of biomass facilities also involves other secondary, support-related emissions-generating activities, including the following:

- Transport of biomass feed stocks. Biomass feed stock is transported by truck to the power plants and due to the relatively low energy content of woody biomass large volumes are needed to keep a plant in continuous operation. However, because costs of hauling are high relative to the energy content of the biomass, plants are typically located in areas with abundant biomass availability, which limits the distances of truck haul trips.
- Feedstock processing. Biomass material needs to be collected, chipped, sorted, and/or dried before they are gasified or combusted to generate power. This often involves the operation of a front loader in the biomass storage area and other processing equipment.
- Combustion of starter fuel. Natural gas is typically combusted during start up and shut down of direct combustion biomass plants to maintain flame stabilization.
- Water consumption, wastewater treatment, and waste handling. GHG emissions are associated with energy consumed for the conveyance and treatment of water and wastewater, as well as the handling and off-hauling of byproducts such as ash and biochar.
- Worker commute trips and maintenance activities, generating mobile-source emissions.
- Facility construction, which is relatively small when amortized over the operational life of a facility.

While all of these secondary, support-related activities would result in new GHG emissions relative to existing conditions, the size of the net increase would not be substantial. Project-level quantitative analyses of individual biomass power facilities indicate that secondary, support-related emission of CO_2e would be approximately 4 to 8 percent of direct emissions (Placer County 2012:10-14; Amador County 2010:4.10-14, Shasta County 2012:2.0-33).

A modeling study by the California Energy Commission suggests that biomass power facilities that consume hazardous fuels removed from forests provide a GHG benefit over time because the thinned forests are less likely to become subject to more intense, catastrophic, GHG-emitting wildfires (CEC 2010:xi). Over time, the reduction in wildfire-generated emissions could offset secondary, support-related emissions. Similarly, forest thinning may enable forests to optimize their carbon sequestration potential. However, the degree to which biomass power plants enable more forest thinning activity to take place than would otherwise occur is not well established and this extent of this beneficial effect cannot be quantified.

The addition of any new biomass power plants serving the grid would help the state achieve its RES goal because they offer another method for producing RES-qualifying power. Any power plant using renewable biomass fuels would not likely displace more GHG-intensive fossil natural gas-fired power plants because they would not be economically competitive without substantial subsidies. The state's RES goals will be attained by some mix of solar, wind, geothermal, and qualifying biomass power plants and its unlikely that substantially more renewable power will be produced than is mandated by RES with or without the addition of new biomass power facilities. One advantage of biomass power facilities, however, is that unlike intermittent resources such as solar and wind, biomass facilities are dispatchable and can supply electricity on a 24/7 basis and, therefore, can serve base load demand.

Thus, long-term operational GHG emissions impacts associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants

Impact 8.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

Long-Term Operational Impacts

The Proposed Update includes increasing the use of low-GWP systems and replacing currently used high-GWP gases associated with refrigerators, air conditioners, and foam insulation. Reducing the use of these products would control emissions of HFCs, a fast-growing GHG sources. Controlling these emissions, through implementation of the Short-Lived Climate Pollutants Sector recommendations would result in reduced GHG emissions.

Thus, long-term operational GHG emissions impacts associated with the Short-Lived Climate Pollutants Sector would be **beneficial**.

h) Green Building

Impact 8.h

Short-Term Construction-Related Impacts

The Proposed Update recommends actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects. The types of construction-related impacts related to GHG emissions would be of similar type and magnitude as those discussed under Impact 8.a under the Energy Sector.

Thus, short-term construction-related GHG emissions impacts associated with Green Buildings would be **less than significant**.

Long-Term Operational Impacts

Green buildings are designed, constructed, operated, and maintained to maximize energy efficiency, conserve water, and minimize waste. They are also planned in areas that encourage people to walk, bike, or take public transit rather than drive cars. By comprehensively creating communities that have minimal energy demand and carbon sequestration features, GHG emissions would be reduced compared to existing typical structures and community design.

Thus, long-term operational GHG emissions impacts associated with Green Buildings would be **beneficial**.

i) Cap-and-Trade Regulation

Impact 8.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. , the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocolsThe covered entity compliance responses consisting of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involves construction activities, possibly including the operation of heavy equipment, that could result in emissions of GHGs during installation of equipment upgrades and/or incidental construction. These emissions would be short-term and considered less than significant.

Ongoing implementation of the Cap-and-Trade Regulation is expected to continue to reduce GHG emissions which is a beneficial effect.

Impacts related to CCS are described above under the Energy Sector.

9. Hazards and Hazardous Materials

a) Energy Sector

Impact 9.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves). Although there is uncertainty as to the exact locations where new facilities could be constructed or where existing facilities could be reconstructed, these would likely occur within footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses.

These construction activities may require the transport, use, and disposal of hazardous materials. Construction activities generally use heavy-duty equipment requiring periodic refueling and lubricating fluids. Large pieces of construction equipment (e.g., backhoes, graders) are typically fueled and maintained at the construction site as they are not designed for use on public roadways. Thus, such maintenance uses a service vehicle that mobilizes to the location of the construction equipment. It is during the transfer of fuel that the potential for an accidental release is most likely. Although precautions

would be taken to ensure that any spilled fuel is properly contained and disposed, and such spills are typically minor and localized to the immediate area of the fueling (or maintenance), the potential still remains for a significant release of hazardous materials into the environment. Consequently, the construction activities could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

Thus, the short-term construction-related impact associated with the Energy Sector on hazards and hazardous materials would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB

Mitigation Measure 9.a(1)

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that provide protection of geology and soils. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid upset and accident-related impacts include:

- Proponents of new or modified facilities constructed as a compliance response would coordinate with local land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant upset and accident-related hazard impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
- Handling of potentially hazardous materials/wastes should be performed under the direction of a licensed professional with the necessary experience and knowledge to oversee the proper identification, characterization, handling and disposal or recycling of the materials generated as a result of the project. As wastes are generated, they would be placed, at the direction of the

licensed professional, in designated areas that offer secure, secondary containment and/or protection from stormwater runoff. Other forms of containment may include placing waste on plastic sheeting (and/or covering with same) or in steel bins or other suitable containers pending profiling and disposal or recycling.

- The temporary storage and handling of potentially hazardous materials/wastes should be in areas away from sensitive receptors such as schools or residential areas. These areas should be secured with chain-link fencing or similar barrier with controlled access to restrict casual contact from non-Project personnel. All project personnel that may come into contact with potentially hazardous materials/wastes will have the appropriate health and safety training commensurate with the anticipated level of exposure.

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction impacts regarding upset and accident-related hazards associated with the Energy Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

As noted above, although there is uncertainty as to the exact locations where new facilities could be constructed or where existing facilities could be reconstructed, these would likely occur within footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of the Energy Sector recommendations would not be anticipated to result in locating facilities near schools, public (or public use) airports, private air fields, or wildlands; or on land included on a list of hazardous materials sites or impair implementation of or physically interfere with an adopted emergency response or evacuation plan. The handling of hazards materials would be required to comply with all applicable federal, State and local laws.

As discussed above, the Energy Sector recommendations could also result in construction of CCS facilities. Geologic sequestration involves the injection of CO_2 thousands of feet underground where it is trapped within the pore spaces of solid rock. US EPA requires that sequestration sites have confining subsurface zones, or layers of impermeable rock, to keep CO_2 from escaping into overlying geologic layers, ground water, or the surface (40 CFR 146.83(a)(2)). Under the geologic sequestration rule, US EPA requires that potential geologic sequestration sites be thoroughly studied to protect

the safety and security of the project. Geologic sequestration is not allowed where unsuitable subsurface conditions exist, and all underground injection projects must obtain permits to ensure the protection of underground drinking water sources or the surface. (40 CFR 146.82(a)(3)) (EPA 2010b).

CCS systems may include EOR. Technologies to implement CCS/EOR projects are evolving. For instance, projects are currently underway to consider mobility control of the injected CO_2 using novel foams and gels (DOE 2014). In addition, use of industrial sources of CO_2, such as coal-based energy producers and fertilizer manufacturing plants, could contain impurities (i.e., injected agents may include other constituents, rather than only pure CO_2, that could become contaminants). Although operators would take steps to ensure that pressure is maintained to trap sequestered CO_2 and other potential constituents, the risk would remain that some emissions could be released into the air, soil, aquifers, or surface waterways as a result of unidentified and/or poorly abandoned wells or other pathways (e.g., natural fractures).

The regulatory framework for EOR is also evolving. While the development of an environmentally protective, regulatory framework to address EOR project implementation in California is ongoing, specific requirements and limitations have not yet been fully established, so potential risks of hazards and contamination cannot be entirely dismissed.

Upon extraction of oil, there is a potential for accidental release during the transport of fuel. Although precautions would be taken to ensure that any spilled fuel is properly contained and disposed, and such spills are typically minor and localized to the immediate area of the fueling (or maintenance), the potential still remains for a significant release of hazardous materials into the environment (resulting in either a hazard event or contamination of soil, water, and/or air). Consequently, long-term operations could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

The long-term operational impact associated with the Energy Sector on hazards and hazardous materials would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 9.a(2)

The Regulatory Setting in Attachment 2 includes applicable laws and regulations in regards to hazards and hazardous materials. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The

jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes.

Permits and/or agreements to reduce potential hazards and hazardous materials impacts could include, but are not limited to, Underground Injection Control (UIC) permits administered pursuant to the SDWA at the federal and State and levels. The US EPA issues Class VI permits under these regulations, which apply to injections wells that are drilled for the sole purpose of CO_2 injection in an underground formation as part of a CCS project, without any other intended purpose. DOGGR issues Class II permits under regulatory authority granted by US EPA pursuant to UIC regulations. Class II permits apply to injection wells created for the purpose of extracting oil and gas, including injection wells used for EOR methods that could also be used for the purpose of CO_2 sequestration as part of a CCS project. Furthermore, ARB will develop regulations, and complete all pertinent environmental review, to limit the types of technologies available for use during project operation.

To obtain these permits, the project proponent would be required to conduct various evaluations, such as engineering studies, geologic study, and injection plans. Requirements for these permits are likely to include: isopach maps, cross sections, and a representative electric log that identifies all geologic units, formations, freshwater aquifers, and oil or gas zones. In addition, CEQA and/or other necessary regulatory processes would be completed to address and mitigate potential environmental effects. Because these actions would address inspection, enforcement, mechanical integrity testing, plugging and abandonment oversight, data management, public outreach, and potential environment effects, this impact could be reduced to a less than significant level.

Consequently, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant long-term operational impact regarding upset and accident-related hazards could be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 9.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could

require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of hazard impacts associated with the Transportation Sector would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with the Transportation Sector on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.b: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with the Transportation Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Compliance responses associated with the Transportation Sector includes implementation of LCFS, which incents change in the types of fuels used in vehicles. All internal combustion engine vehicles have the potential to release chemicals into the environment. These releases may occur as emissions to the air during fuel combustion, as well as through spills and leaks during fueling and vehicle use. Several studies have determined that use of biodiesel (i.e., a low-carbon fuel), instead of conventional diesel may be expected to exhibit large reductions in hydrocarbons, PM, and CO emissions. However, biodiesel is produced from a variety of feedstocks, including: common vegetable oils (soybean, palm, rapeseed/canola, sunflower, safflower, algae, cottonseed, peanut), animal fats, and waste oils (used frying oils, trap grease). The

content of the oils determines the level of pretreatment needed to produce usable fuel formulations.

In addition, to providing a stable, useful, and reliable fuel, additive chemicals would need to be introduced into biodiesel blends to control oxidation, corrosion, foaming, cold temperature flow properties, biodegradation, water separation, and NO_X formation. (See Long-Term Operational Impact 3.b). The specific chemicals and amounts that could be used have not been well-defined at the time of public review of the Proposed Update. Thus, because the types of chemicals that could be used are currently unknown, the potential for release of hazardous materials during the use of low-carbon fuels, cannot be entirely precluded.

However, the LCFS program is being developed with consideration of recommendations provided in the Biodiesel Multimedia Evaluation report (Cal/EPA 2013). This report has concluded that, in general, life cycle pollutant emissions from pure biodiesel are considerably less toxic than life cycle pollutant emissions from petroleum-derived fuels. In addition, additives that could be used in low-carbon fuels are likely to be similar to those used in existing fuels (i.e., ultra-low-sulfur diesel), and are, therefore, not anticipated to pose a substantially increased risk to the environment. Furthermore, as the biodiesel industry and market become more developed, additional evaluations will be prepared to address issues including:

- Investments to improve the knowledge base,
- Formulation of processes used to collect and manage new information,
- Formulation of processes to evaluate and communicate uncertainty, and
- Adjustment of the risk assessment process to mitigate the practical impacts of uncertainty on decision-making.

Thus, because research is ongoing, and the proposed program and analysis will address long-term operational impacts associated with low-carbon fuels would be minimized to the extent feasible, it can be assumed that fuel formulations would pose a similar level of hazards risk compared to existing fuels.

Long-term operational hazards and hazardous materials impacts associated with the Transportation Sector would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 9.c

Short-Term Construction-Related Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used

in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands.

Short-term construction-related impacts under the Agriculture Sector associated with the transport, use, and disposal of hazardous materials would be **less than significant**.

Long-Term Operational Impacts

Unintentional releases of biogas from dairy digester facilities or pipelines could pose risks to human health and safety. For example, biogas could be released from a leak or rupture of the digester facility or one of the pipe segments. If the gas reaches a combustible mixture and an ignition source is present, a fire and/or explosion could occur, resulting in possible injuries and/or deaths.

Compliance with existing safety regulations and widely-accepted industry standards would minimize the hazard to the public and the environment. With respect to the flaring of biogas and potential fire hazards associated with the storage and transport of CH_4 and small quantities of other materials used in operations, the National Fire Protection Agency (NFPA) has established standards for fire protection which would be applicable to the construction of dairy digester and co-digester facilities. These standards have been successfully implemented by numerous waste water treatment facilities across the country. Construction and operation of facilities would comply with the California fire code, local building codes (including requirements for the installation of fire suppression systems), and gas pipeline regulations. The local fire agency would be responsible for enforcing the provisions of the fire code. The CPUC regulates the safety of gas transmission pipelines. Standard safety measures for anaerobic treatment facilities that would minimize the potential for exposure to biogas include leak detection systems, warning signals, and safety flares to reduce excess gas capacity. If released to the environment, CH_4 would be dispersed rapidly in air, minimizing exposure-related hazards.

Dairies in the Central Valley Water Board region are predominantly located in agricultural areas that are not within high wildfire hazard zones. In addition, due to odor and other siting considerations, dairy digester and co-digester facilities would not be constructed immediately adjacent to residential structures. Compliance with existing laws and regulations would reduce the potential for fires and explosions associated with digester and co-digester facilities; however, in the unlikely event of a fire, the potential to expose people or structures to a significant risk involving fires is low.

Issues associated with proximity to hazardous materials sites (e.g., for schools and airports) would be of similar types and magnitude as described under Impact 9.a.

Therefore, hazards and hazardous materials long-term operational impacts associated with the Agriculture Sector would be **less than significant**.

d) Water Sector

Impact 9.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of hazard impacts associated with the Water Sector would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with the Water Sector on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.d: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with the Water Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Recommended actions associated with the Water Sector could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. These types of facilities are typical features within urban settings, and do not pose a substantial risk to the general public. While this process could expose workers to hazards if an accident were to occur, it can be assumed that systems would be built, operated, and maintained to meet applicable federal, State, and local regulations pertaining to general workplace safety (e.g., OSHA).

Impacts related to operational emissions that could be hazardous (i.e., CAPs and TACs), are discussed under Impact 3.f.

Thus, long-term operational impacts on hazards and hazardous materials associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 9.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling, development of waste-to-energy facilities, and installation of new CH_4 control devices at landfills.

The types of hazard impacts associated with the Waste Management Sector would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with the Waste Management Sector on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.e: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with the Waste Management Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Operation and maintenance of anaerobic digestion facilities would involve the transport, use, storage and disposal of hazardous materials such as fuels, lubricants and hydraulic fluids for vehicles and onsite equipment. The biogas produced from the anaerobic digestion process could be used for internal combustion or flared. Biogas presents an inhalation hazard that, if breathed in high concentration, can result in serious injury or death.

Handling of hazardous materials and hazardous wastes is covered by federal and State laws that minimize worker safety risks from both physical and chemical hazards in the workplace. The California Division of Occupational Safety and Health (Cal/OSHA) is responsible for developing and enforcing workplace safety standards, including the handling and use of hazardous materials, including gases. Workers must be trained to understand the hazards and appropriate work procedures associated with confined spaces, flammable gases, etc. Businesses that use hazardous materials are required to submit a Hazardous Materials Business Plan to the local California Unified Program Agency, which performs inspections to address compliance with hazardous materials labeling, training, and storage regulations.

Transportation of hazardous materials is regulated by the US Department of Transportation and Caltrans. Together, federal and State agencies determine driver-training requirements, load labeling procedures, and container specifications designed to minimize the risk of accidental release. Hazardous wastes must be segregated, sampled and disposed of at appropriately licensed landfill facilities.

In addition, operation and maintenance of anaerobic digestions facilities would involve the transport, use, storage and disposal of hazardous materials such as fuels, lubricants and hydraulic fluids for vehicles and onsite equipment. If biogas conditioning is required for use either in a fuel cell or production of liquefied biogas, scrubber facilities would be needed to clean the biogas to remove sulfides. Flushing of the scrubbers would produce sulfide effluent that would require appropriate disposal. Biogas presents an inhalation

hazard that, if breathed in high concentration, can result in serious injury or death. Biogas itself is not explosive and will not burn unless oxygen is available at low concentrations. Handling of hazardous materials and hazardous wastes is covered by federal and State laws that minimize worker safety risks from both physical and chemical hazards in the workplace. Cal/OSHA is responsible for developing and enforcing workplace safety standards, including the handling and use of hazardous materials, including gases. Workers must be trained to understand the hazards and appropriate work procedures associated with confined spaces, flammable gases, etc. Businesses that use hazardous materials are required to submit a Hazardous Materials Business Plan to the local CUPA, which complies with hazardous materials labeling, training, and storage regulations.

Issues associated with proximity to hazardous materials sites (e.g., for schools and airports) would be of similar types and magnitude as described under Impact 9.a.

Because numerous laws and regulations govern the transport, use, storage, handling and disposal of hazardous materials to reduce the potential hazards associated with biogas, this long-term operational impacts associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 9.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommended actions under the Natural and Working Lands Sector could cause an increase in the construction and operation of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning.

The types of hazard impacts associated with the Natural and Working Lands Sector would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with the Natural and Working Lands Sector on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.f: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Reasonably foreseeable compliance responses associated with the Natural and Working Lands Sector include construction and operation of new biomass facilities. Biomass facilities convert biomass, such as woody wastes from forest residues to useful steam, heat, or combustible gases. The two basic types of conversions systems consist of gasification and direct combustion for electricity generation. Gasification systems generate electricity through combustion of syngas (i.e., synthetic gas produced from the conversion of organic solids and liquids under heat and controlled air or oxygen); and direct combustion systems burn biomass in a furnace, which supplies heat to a boiler that produces steam. Syngas, from gasification systems, are used to generate electricity in an internal combustion engine or turbine. Steam, from direct combustion systems, generates electricity through the use of a steam turbine. While this process could expose workers to hazards if an accident were to occur, it can be assumed that systems would be built, operated, and maintained to meet applicable federal, State, and local regulations pertaining to general workplace safety (e.g., OSHA).

Impacts related to operational emissions that could be hazardous (i.e., CAPs and TACs), are discussed under Impact 3.f.

Thus, long-term operational impacts on hazards and hazardous materials associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 9.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of hazard impacts associated with the Short-Lived Climate Pollutants Sector would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with the Short-Lived Climate Pollutants Sector on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.g: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with the Short-Lived Climate Pollutants Sector would be potentially significant and unavoidable.

Long-Term Operational Impacts

Implementation of low GWP compliance measures may result in the use or increase in use of hazardous chemicals. Depending on the chemical used, there may be an increased risk to public safety. For example, while cyclopentane and cyclopentane blends have a lower GWP, cyclopentane is highly flammable in its pure form; however, once foamed, it is no more hazardous than other blowing agents currently in use. As with any manufacturing processes, a wide variety of redundant engineering and operational safeguards are typically integrated, along with compliance with federal, state, and local environmental and health and safety laws and regulations address the management and use of flammable and toxic chemicals.

Some potential heat transfer fluids that could be used to replace high-GWP refrigerants, such as propane and ammonia, are highly flammable. Heavier-than-air refrigerants can concentrate at floor levels and displace breathable oxygen. Inhalation of certain fumes, during accidental release, can also cause human health effects ranging from nausea to death. However, Chapter 11 of the California Mechanical Code regulates the use of refrigeration systems, equipment, and devices, including the replacement of parts, alterations, and substitution of different refrigerants. This includes requirements for ventilation and exhaust systems, emergency control systems, and alarms. Operational impacts associated with proximity (e.g., for schools and airports) to hazardous materials sites would be similar to those described under Impact 9.a.

Long-term operational impacts associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 9.h

Short-Term Construction-Related Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

The types of hazard impacts associated with Green Buildings would be of similar type and magnitude as those discussed under Impact 9.a under the Energy Sector.

The short-term construction-related impact associated with Green Buildings on hazards and hazardous materials would be potentially significant.

The impacts could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 9.h: Implement Mitigation Measure 9.a(1)

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction hazard impacts associated with Green Buildings would be **potentially significant and unavoidable**.

Long-Term Operational impacts

While most technologies that could be used would not require the use of substantial hazardous materials, the production of photovoltaic devices can involve the use of some toxic and explosive gases, corrosive liquids, and suspected carcinogenic compounds. The magnitude of potential effects will vary based on the materials' toxicological properties, and the intensity, frequency, and duration of human exposure. The potential for human exposure to these materials can occur during the manufacturing process, from the leaching of cracked or broken modules, or from the combustion of modules.

The greatest possibility of human health risks associated with photovoltaic devices is related to manufacturing, rather than installation, of these devices. Because of the higher risks of worker exposure, extensive work has been conducted on methods to reduce the hazards to manufacturing plant workers. Worker safety is also regulated by the federal Occupational Safety and Health Administration (OSHA) and similar state agencies. OSHA sets standards for allowable chemical concentrations that workers can be exposed to over an 8-hour work day, in addition to the maximum allowable concentrations without personal protective equipment.

Potential human health risks could occur from the leaching of materials from broken photovoltaic modules. Leaching from cracked or broken modules may occur while the modules are still in service or after they have been disposed of. The primary chemicals of concern from the leaching of photovoltaic modules are heavy metals such as cadmium and selenium. Modules leaching metals onto rooftops of residential houses or commercial buildings appear to pose little risk to human or environmental health (CEC 2003).

Thus, while chemicals contained within, and used during the production of solar panels pose risks to human health, existing laws and regulations (e.g., OSHA) would reduce the risk of exposure to protect against substantial human health risks are reduced to the extent feasible.

Operational impacts associated with proximity (e.g., for schools and airports) to hazardous materials sites would be similar to those described under Impact 9.a.

Long-term operational hazards and hazardous materials, associated with Green Buildings would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 9.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities. The use of hazardous materials is common practice in industrial settings. Implementation of compliance responses could include the use of hazardous materials, but this would be considered simply an extension of business as usual for most covered entities, mitigated by existing practices and regulations, and thus considered less than significant.

Offset projects implemented under the proposed offset protocols may result in the use or transport of hazardous materials that require special handling and disposal. All projects would be required to comply with established local, state, and federal laws pertaining to the use, storage, and transportation of these materials. Assuming compliance with applicable laws and regulations, the impacts would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

10. Hydrology and Water Quality

a) Energy Sector

Impact 10.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and

microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

This increase in demand could require construction of new and/or modified manufacturing plants. Although it is reasonably foreseeable that construction activities could occur, the location and extent construction activities related to new or modified manufacturing facilities cannot be determined at this time.

Construction activities could require disturbance of undeveloped areas, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Specific construction projects would be required to comply with applicable erosion, water quality standards, and waste discharge requirements (e.g., NPDES, SWPPP). With respect to depleting groundwater supplies, impairing quality, and runoff issues, construction new facilities would not be anticipated to result in substantial demands due to the nature of associated activities.

Short-term construction-related impacts to hydrologic resources associated with the Energy Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations in regards to hydrology and water quality. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or mitigate hydrology and water quality-related impacts include the following:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance responses to new regulations would coordinate with local or State land use agencies to seek entitlements for development

including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all feasible mitigation identified in the environmental document to reduce or substantially lessen the potentially significant impacts associated with altering drainage patters, flooding, and inundation by seiche, tsunami, or mudflow. The definition of actions required to mitigate potentially significant hydrology and water quality impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
    - Under the oversight of the local lead agency, prior to issuance of any construction permits, the proponents for the proposed renewable energy project would prepare a stormwater drainage and flood control analysis and management plan. The plans would be prepared by a qualified professional and would summarize existing conditions and the effects of project improvements, and would include all appropriate calculations, a watershed map, changes in downstream flows and flood elevations, proposed on- and off-site improvements, features to protection downstream uses, and property and drainage easements to accommodate downstream flows from the site. Project drainage features would be designed to protect existing downstream flow conditions that would result in new or increased severity of offsite flooding.
    - Establish drainage performance criteria for off-site drainage, in consultation with county engineering staff, such that project-related drainage is consistent with applicable facility designs, discharge rates, erosion protection, and routing to drainage channels, which could be accomplished by, but is not limited to: (a) minimizing directly connected impervious areas; (b) maximizing permeability of the site; and, (c) stormwater quality controls such as infiltration, detention/retention, and/or biofilters; and basins, swales, and pipes in the system design.
    - The project proponent would design and construct new facilities to provide appropriate flood protection such that operations are not adversely affected by flooding and inundation. These designs would be approved by the local or State land use agency. The project proponent would also consult with the appropriate flood control authority on the design of offsite stream crossings such that the minimum elevations are above the predicted surface-water elevation at the agency's designated design peak flows. Drainage and flood prevention features shall be inspected and maintained on a routine schedule specified in the facility plans, and as specified by the county authority.
    - As part of subsequent project-level planning and environmental review, the project proponent shall coordinate with the local groundwater management authority and prepare a detailed hydrogeological analysis

> of the potential project-related effects on groundwater resources prior to issuance of any permits. The proponent shall mitigate for identified adverse changes to groundwater by incorporating technically achievable and feasible modifications into the project to avoid offsite groundwater level reductions, use alternative technologies or changes to water supply operations, or otherwise compensate or offset the groundwater reductions.

Mineral extraction and mining activities within the United States would be required to comply with the provisions of the Clean Water Act and the natural resource protection and land reclamation requirements of the appropriate state and federal land managers. The strongest protections for hydrologic resources are found in the Bureau of Land Management (BLM) and US Forest Service mining permit conditions. All projects on federal lands would be required to provide disclose potential impacts as required by the National Environmental Policy Act. On BLM lands, all mining operations are subject to monitoring by the BLM to protect against unnecessary or undue degradation, and that all operators are responsible for fully reclaiming the area of their claim. Reclamation requires restoration of disturbed areas to stable, self-sustaining, and productive conditions which comply with the land-use plan for the area (EPA 1994). The US Forest Service enforces similar mining reclamation standards for the land it manages. Reclamation requirements for mining operations on private lands vary from state to state. In some developing countries which supply mineral resources to the United States, environmental oversight and requirements for reclamation are effectively nonexistent (Vidal *et* al. 2013).

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts associated with the Energy Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

New manufacturing facilities and renewable energy projects could be located in a variety of conditions with regards to altering drainage patterns, flooding, and inundation by seiche, tsunami, or mudflow. The level of susceptibility varies by location. The specific design details, siting locations, and associated hydrology and water quality issues are not known at this time and would be analyzed on a site-specific basis at the project level.

Iron, copper, and aluminum are required in large quantities for the manufacturing of wind turbines and photovoltaic panels. Rare metals are also required such as lithium used for lithium-ion batteries to power electric vehicles and store energy for delayed release. Analysts predict that the global production of aluminum and copper will be required to increase 5 – 18 percent annually in order to meet global targets for wind and solar energy (Vidal *et* al. 2013). The Copper Development Association projects that the five year demand resulting from renewable energy integration and grid energy storage within the US could exceed 3,000 tons of copper (CDA 2012). The risk of water quality degradation resulting from the mining process used to extract these minerals is dependent on the environmental oversight of the area where the mining occurs. In general, contamination of groundwater can occur during the process of leaching mineral ore from crushed bedrock, infiltration of unlined tailing impoundments, and from acidified mine drainage at abandoned sites. Surface waters can be contaminated by runoff from exposed spoil and overburden piles. Surface-water discharge and seepage from tailings ponds and dams can also contain high concentrations of heavy metals (EPA 1994).

In addition, some areas that would be typical for renewable energy supplies (e.g., the desert) rely on groundwater resources. These water supplies could be required for evaporative cooling, washing of solar panels, dust control, and domestic use by the workforce. These facilities may also require new compacted or paved impervious surfaces that could increase the amount of stormwater runoff. Additional stormwater runoff may contribute to localized drainage-related problems, such as increased drainage channel flows and stream flows, potential increases or exceedances of channel capacities leading to flooding, increased erosion and sedimentation, or damage from inundation of property and structures from increase drainage volumes.

Finally, reasonably foreseeable compliance responses associated with the Energy Sector could result in implementation of CCS/EOR projects. Technologies to implement CCS/EOR projects are evolving. For instance, projects are currently underway to consider mobility control of the injected CO_2 using novel foams and gels (DOE 2014). In addition, use of industrial sources of CO_2, such as coal-based energy producers and fertilizer manufacturing plants, could contain impurities (i.e., injected agents may include other constituents, rather than only pure CO_2, that could become contaminants). Although operators would take steps to ensure that pressure is maintained to trap sequestered CO_2 and other potential constituents, the risk would remain that some emissions could be released into the air, soil, aquifers, or surface waterways as a result of unidentified and/or poorly abandoned wells or other pathways (e.g., natural fractures).

The regulatory framework for EOR is also evolving. While the development of an environmentally protective, regulatory framework to address EOR project implementation in California is ongoing, specific requirements and limitations have not yet been fully established, so potential risks of contamination cannot be entirely dismissed.

Long-term operational impacts to hydrologic resources associated with the Energy Sector would be potentially significant.

Operational impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.b(1): Implement Mitigation Measure 10.a

Mitigation Measure 10.b(2)

The Regulatory Setting in Attachment 2 includes applicable laws and regulations in regards to hydrology and water quality. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes.

Permits and/or agreements to reduce potential hydrology and water quality impacts could include, but are not limited to, Underground Injection Control (UIC) permits administered pursuant to the SDWA at the federal and State and levels. The US EPA issues Class VI permits under these regulations, which apply to injections wells that are drilled for the sole purpose of CO_2 injection in an underground formation as part of a CCS project, without any other intended purpose. DOGGR issues Class II permits under regulatory authority granted by US EPA pursuant to UIC regulations. Class II permits apply to injection wells created for the purpose of extracting oil and gas, including injection wells used for EOR methods that could also be used for the purpose of CO_2 sequestration as part of a CCS project. Furthermore, ARB will develop regulations, and complete all pertinent environmental review, to limit the types of technologies available for use during project operation.

To obtain these permits, the project proponent would be required to conduct various evaluations, such as engineering studies, geologic study, and injection plans. Requirements for these permits are likely to include: isopach maps, cross sections, and a representative electric log that identifies all geologic units, formations, freshwater aquifers, and oil or gas zones. In addition, CEQA and/or other necessary regulatory processes would be completed to address and mitigate potential environmental effects. Because these actions would address inspection, enforcement, mechanical integrity testing, plugging and abandonment oversight, data management, public outreach, and potential environment effects, this impact could be reduced to a less than significant level.

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of

mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that long-term operational impacts to hydrologic resources associated with the Energy Sector would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 10.b

Short-Term Construction-Related and Long-Term Operational Impacts

The recommended actions associated with the Transportation Sector could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts to hydrologic resources related to the manufacturing of these technologies associated with the Transportation Sector would be of similar type and magnitude as those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to hydrologic resources associated with the Transportation Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.b: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative

approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts to hydrologic resources associated with the Transportation Sector would be **potentially significant and unavoidable.**

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 10.c

Short-Term Construction-Related Impacts and Long-Term Operational

Compliance responses associated with the recommended actions in the Agriculture Sector would incentivize efficient and precise use of nitrogen fertilizers and irrigation water, conservation tillage practices, and land use planning strategies that protect croplands, forests, rangelands, and wetlands. These programs would reduce the over application of nitrogen fertilizers which, combined with excessive irrigation, can result in the degradation of surface and groundwater resources.

Implementation of reduced tillage and conservation tillage programs would reduce sediment loading in runoff and would protect surface waters. Overall, implementation of recommendations actions in the Agriculture Sector would increase conservation of hydrologic resources.

Short-term construction-related and long-term operational impacts to hydrologic resources associated with the Agriculture Sector would be **beneficial**.

d) Water Sector

Impact 10.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling,

stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types impacts on hydrology and water quality associated with the Water Sector would be of similar type and magnitude as those discussed under Impact 10.a for the Energy Sector.

Short-term construction-related and long-term operational impacts to hydrologic resources associated with the Water Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.d: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to hydrologic resources associated with the Water Sector would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 10.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the recommended actions in the Waste Management sector could require construction and operation of new, or expansion of existing, composting and anaerobic digestion facilities. With the exception water quality impacts related to mineral extraction, impacts to hydrologic resources resulting from the Water Management

recommendations would be of similar type and magnitude as those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to hydrologic resources associated with the Waste Management Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.e: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related and long-term operational impacts to hydrologic resources associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 10.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

With the exception of water quality impacts related to mineral extraction, impacts to hydrologic resources resulting from the Natural and Working Lands Sector recommendations would be of similar type and magnitude as those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related impacts to hydrologic resources associated with the Natural and Working Lands Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.f: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts to hydrologic resources would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Compliance responses associated with the recommended actions in the Natural and Working Lands Sector could involve development of programs designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. These actions could reduce the amount of contaminant and sediment laden urban runoff that reaches surface waters. These actions would contribute to increased conservation of hydrologic resources.

Long-term operational impacts on hydrologic resources associated with the Natural and Working Land Sector would be **beneficial**.

g) Short-Lived Climate Pollutants Sector

Impact 10.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs.

The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriate zoned to accommodate them.

With the exception water quality impacts related to mineral extraction, impacts to hydrologic resources associated with the Short-Lived Climate Pollutants Sector, resulting from these recommendations, would be of similar type and magnitude as those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related and long-term operational impacts to hydrologic resources associated with the Short-Lived Climate Pollutant Sector would be potentially significant.

Impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.g: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction and long-term operational impacts to hydrologic resources resulting from the development new facilities or modification of existing facilities would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 10.h

Short-Term Construction-Related Impacts

The recommended actions for Green Buildings include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Reasonably foreseeable compliance responses include increased demand for renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and funding of carbon offset technologies, including solar PV or wind turbine farms, which could require new or expanded manufacturing facilities or renewable energy projects.

These activities associated with Green Buildings would result in construction-related impacts to hydrologic resources similar in type and magnitude to those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related impacts to hydrologic resources associated with Green Buildings would be potentially significant.

Construction-related impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.h: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that short-term construction-related impacts to hydrologic resources associated with Green Buildings would be **potentially significant and unavoidable**.

Long-Term Operational- Impacts

Operation of renewable energy projects would result in the same types of operational impacts as discussed under Impact 10.a.

Long-term operational impacts to hydrologic resources associated with Green Buildings would be potentially significant.

Operational impacts to hydrologic resources could be reduced to a less-than-significant level by mitigation that can and should be implemented by federal, state, and local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 10.h: Implement Mitigation Measure 10.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that long-term operational impacts to hydrologic resources associated with Green Buildings would be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 10.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities involve construction, grading and trenching which have the potential to result in adverse soil erosion, resulting in sedimentation and degradation of local waterways. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact may be potentially significant and unavoidable.

Implementation of projects under the ODS Offset Protocol would have no adverse impacts on hydrology and water quality. Implementation of projects under the Livestock Offset Protocol would include the construction of digesters that would be subject to regulations which are considered sufficient to mitigate potential impacts to hydrology and water quality to a less than significant level. Implementation of projects under the Urban Forest Offset Protocol would result in only minor soil disturbance resulting in less than significant impacts to hydrology or water quality. Implementation of projects under the Forest Offset Protocol would not increase total forest activities, but could shift activities to projects that increase carbon sequestration. Because the overall level of forest activities would not change, the potential to adversely impact hydrology and water quality would not change. This impact would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

11. Land Use and Planning

a) Energy Sector

Impact 11.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. In some cases, new facilities could be located on public lands; for instance, a solar PV farm could be located in desert or grassland areas. However, coordination with the appropriate agencies with land use authority would be required, and the appropriate level of environmental review would be completed before installation could occur. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Energy Sector would be **less than significant**.

b) Transportation Sector

Impact 11.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could

require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities. New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Transportation Sector would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 11.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. Planning efforts could increase conservation of agricultural and forest lands. While conservation-oriented planning efforts may lead to indirect, beneficial environmental effects to various resources areas including, air quality, GHG emissions, and biology, they may not be consistent with existing, local or State land use goals and policies. However, planning efforts associated with the Agriculture Sector would be made in coordination with local, State, or federal jurisdictions. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Agriculture Sector would be **less than significant**.

d) Water Sector

Impact 11.d

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a

comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur.

The types of construction-related and long-term operational impacts on land use would be of similar type and magnitude as those discussed under Impact 11.a for the Energy Sector.

Short-term construction-related and long-term operational land use impacts associated with the Water Sector would be **less than significant**.

e) Waste Management

Impact 11.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 11.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

Planning efforts could increase green infrastructure, create interconnected lands, and limit future conversions of undeveloped lands. These types of planning efforts would generally avoid and/or mitigate environmental effects (i.e., environmental effects associated with GHG emissions). Further, these would likely be consistent, or complement nearby habitat conservation plans and natural community conservation plans. While conservation-oriented planning efforts may lead to indirect, beneficial environmental effects to various resources areas including, air quality, GHG emissions, and biology, they may not be consistent with existing, local or State land use goals and policies. However, planning efforts associated with Natural and Working Land Sector recommendations would be made in coordination with local, State, or federal jurisdictions.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning.

New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 11.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them. New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 11.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

New facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Thus, implementation of new regulations and/or incentive measures would not be anticipated to divide an established community or conflict with a land use or conservation plan.

Short-term construction-related and long-term operational land use impacts associated with Green Buildings would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 11.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes at existing facilities would be consistent with the existing land use and would pose a less than significant land use and planning impact.

Implementation of projects under the ODS Offset Protocol would use existing facilities, representing a less than significant impact to land use and planning. Implementation of projects under the Livestock Offset Protocol would allow the construction of digesters in agricultural settings. Digesters are typically an allowed use in agricultural areas. As such, their construction would not conflict with existing land use plans, and thus would be a less than significant impact. Projects implemented under the Urban Forest Offset Protocol would not conflict with land use plans, resulting in a less than significant impact. Implementation of projects under the Forest Offset Protocol includes avoided conversion projects that could conflict with local land use plans that envision development or other uses of forested areas. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the impact described as possible conflicts between the “avoided conversion” element of the Forest Offset Protocol and land use plans may be potentially significant and unavoidable.

Impacts related to CCS are described above under the Energy Sector.

12. Mineral Resources

a) Energy Sector

Impact 12.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Although it is reasonably foreseeable that construction activities could occur, the location and extent construction activities related to new or modified manufacturing facilities cannot be determined at this time. However, new facilities would likely occur within existing footprints or in areas with consistent zoning, where original permitting and analyses considered these issues. As a result, construction of new facilities and renewable resource projects would not affect the availability of a known mineral resource or recovery site.

Thus, short-term construction-related mineral resources impacts associated with the Energy Sector would **be less than significant**.

Long-Term Operational Impacts

Compliance with the recommended actions in the Energy Sector could result in increased demand for common (i.e. iron, copper, and aluminum) and rare (i.e. lithium) minerals. Increased demand could stimulate more aggressive mineral exploration as well as wider distribution of efficient and modern mining technologies. However, minerals are already used in a variety of products, including gasoline-powered vehicles. Implementation of recommended actions in the Energy Sector would not be expected to increase demand to the point that worldwide mineral resources could become exhausted and no longer available.

Thus, and long-term operational impacts on mineral resources, associated with the Energy Sector, would be **less than significant**.

b) Transportation Sector

Impact 12.b

Short-Term Construction-Related Impacts

The recommended actions associated with the Transportation Sector could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations.

The types of impacts to mineral resources related to the manufacturing of these technologies would be of similar type and magnitude as those discussed under Impact 10.a under the Energy Sector.

Thus, short-term construction-related mineral resources impacts associated with the Transportation Sector would be **less than significant**.

Long-Term Operational Impacts

Compliance with the recommended actions in the Transportation Sector could result in increased demand for common (i.e., iron, copper, and aluminum) and rare (i.e., lithium) minerals. Increased demand could stimulate more aggressive mineral exploration as well as wider distribution of efficient and modern mining technologies. However, minerals are already used in a variety of products, including gasoline-powered vehicles. Implementation of recommended actions in the Energy Sector would not be expected to increase demand to the point that worldwide mineral resources could become exhausted and no longer available (ARB 2012b).

Thus, and long-term operational impacts on mineral resources, associated with the Transportation Sector, would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 12.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the recommended actions in the Agriculture Sector would incentivize efficient and precise use of nitrogen fertilizers and irrigation water, conservation tillage practices, and land use planning strategies that protect

croplands, forests, rangelands, and wetlands. These programs are not expected to affect the availability of known mineral resources or recovery sites and would not increase demand for mineral resources.

Short-term construction-related and long-term operational mineral resources impacts associated with the Agriculture Sector would be **less than significant**.

d) Water Sector

Impact 12.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related and long-term operational impacts on mineral resources would be of similar type and magnitude as those discussed under Impact 10.a for the Energy Sector.

Short-term construction-related and long-term operational mineral resources impacts associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 12.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the recommended actions in the Waste Management Sector could result in construction of new, or expansion of existing, composting and anaerobic digestion facilities. New facilities would likely occur within existing footprints or in areas with consistent zoning, where original permitting and analyses considered these issues. As a result, construction of new facilities and renewable resource projects would not impact the availability of a known mineral resource or recovery site. Additionally, implementation of the Waste Management recommendations would not create increased demand for mineral resources.

The types of construction-related and operational impacts on mineral resources would be of similar type and magnitude as those discussed under Impact 10.a for the Energy Sector.

Short-term construction-related and long-term operational mineral resources impacts associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 12.f

Short-Term Construction-Related Impacts and Long-Term Operational

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

Compliance responses associated with the recommended actions in the Natural and Working Land Sector could involve development of programs designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Additionally, the recommendations for the Natural and Working Lands sector could result in new demand for the construction of facilities that would be used to

convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related and long-term operational impacts on mineral resources would be of similar type and magnitude as those discussed under Impact 10.a for the Energy Sector.

Short-term construction-related and long-term operational mineral resources impacts associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 12.g

Short-Term Construction-Related Impacts and Long-Term Operational

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriate zoned to accommodate them.

The types of construction-related and long-term operational impacts on mineral resources would be of similar type and magnitude as those discussed under Impact 10.a for the Energy Sector.

Short-term construction-related and long-term operational mineral resources impacts associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 12.h

Short-Term Construction-Related Impacts

The recommended actions for Green Buildings include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Reasonably foreseeable compliance responses include increased demand for renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and funding of carbon offset technologies, including solar PV or wind turbine farms, which could require new or expanded manufacturing facilities or renewable energy projects. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

These activities would result in impacts to mineral resources similar in type and magnitude to those discussed under Impact 10.a under the Energy Sector.

Short-term construction-related mineral resources impacts associated with Green Buildings would be **less than significant**.

Long-Term Operational Impacts

Implementation of a compliance response that would require the long-term construction of ZNE and zero-net carbon buildings would require on-going mining activities to produce various renewable energy systems. For instance, mineral resources would be needed to produce solar panels to be used in ZNE homes. Metals such as cadmium, gallium, germanium, indium, selenium, and tellurium are important mineral materials used in current photovoltaic cell technology. Most of the world's primary supply of these mineral commodities is recovered as byproducts from ores processed mainly for the purpose of producing aluminum, copper, lead, and zinc and, in the case of germanium, from ash derived from burning coal for the production of energy. In some cases, the refined metals originate in the countries in which they are mined, while in other cases, intermediate products containing the metals and refined metals are recovered by processers located in other countries. Assuming that the modest rate of market penetration of electricity from photovoltaic cells and competing markets increases demand for cadmium, gallium, and germanium, the resulting new demand can be met in relatively quick order with the expansion of existing recovery circuits or the addition of new circuits. It is very unlikely that, under most scenarios, the need would arise to mine more bauxite, copper, and zinc ore or to burn more coal to satisfy anticipated material requirements to meet the photovoltaic-generated demand for these mineral materials. For other metals, such as indium, selenium, and tellurium, targeted mineral exploration and improvements in metallurgical recoveries are likely to be needed to meet demand requirements. Substitution for these materials in non-photovoltaic applications could also "free up" supply. Conversely, however, other new applications can produce supply constraints or increase metal prices and place pressure on their use in photovoltaic technology (USGS 2010).

It is not anticipated that there will be any long-term material constraints that would prevent the development of a substantial amount of energy from photoelectric cells. Reserve estimates are not static; although a particular metal might be considered rare and scarce, if a profit can be made from its recovery, then there will likely be no long-term shortage. Technological advancements driven by the desire to produce energy at a lower cost will likely result in increases in efficiency requiring smaller amounts of these metals per unit of energy produced, substitution with other materials, and other advancements in science (USGS 2010).

Long-term operational mineral resources impacts associated with the Green Building Sector would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 12.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

As summarized above under Impact 7.i, the 2020 FED concluded that mineral resources impacts associated with the Cap-and-Trade Regulations would be less than significant for the compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels and implementing maintenance and process changes as well as implementation of projects under all the offset protocols.

Impacts related to CCS are described above under the Energy Sector.

13. Noise

a) Energy Sector

Impact 13.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Construction noise levels that could result from reasonably foreseeable compliance responses would fluctuate depending on the particular type, number, size, and duration of usage for the varying equipment. The effects of construction noise largely depend on the type of construction activities occurring on any given day, noise levels generated by those activities, distances to noise sensitive receptors, and the existing ambient noise environment in the receptor's vicinity. Construction generally occurs in several discrete stages, each phase requiring a specific complement of equipment with varying equipment type, quantity, and intensity. These variations in the operational characteristics of the equipment change the effect they have on the noise environment of the project site and in the surrounding community for the duration of the construction process.

To assess noise levels associated with the various equipment types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources move around a construction site performing tasks in a recurring manner (e.g., loaders, graders, dozers). Stationary equipment operates in a given location for an extended period of time to perform continuous or periodic operations. Operational characteristics of heavy construction equipment are additionally typified by short periods of full-power operation followed by extended periods of operation at lower power, idling, or powered-off conditions.

Additionally when construction-related noise levels are being evaluated, activities that occur during the more noise-sensitive evening and nighttime hours are of increased concern. Because exterior ambient noise levels typically decrease during the late evening and nighttime hours as traffic volumes and commercial activities decrease, construction activities performed during these more noise-sensitive periods of the day can result in increased annoyance and potential sleep disruption for occupants of nearby residential uses.

The site preparation phase typically generates the most substantial noise levels because of the on-site equipment associated with grading, compacting, and excavation, which uses the noisiest types of construction equipment. Site preparation equipment and activities include backhoes, bulldozers, loaders, and excavation equipment (e.g., graders and scrapers). Construction of large structural elements and mechanical systems could require the use of a crane for placement and assembly tasks, which may also generate noise levels. Although a detailed construction equipment list is not currently available, based on this project type it is expected that the primary sources of noise would include backhoes, bulldozers, and excavators. Noise emission levels from typical types of construction equipment can range from approximately 74 to 94 dBA at 50 feet.

Based on this information and accounting for typical usage factors of individual pieces of equipment and activity types, on-site construction could result in hourly average noise levels of 87 dBA L_{eq} at 50 feet and maximum noise levels of 90 dBA L_{max} at 50 feet from the simultaneous operation of heavy-duty equipment and blasting activities, if deemed necessary. Based on these and general attenuation rates, exterior noise levels at noise-

sensitive receptors located within thousands of feet from project sites could exceed typical standards (e.g., 50/60 dBA L_{eq}/L_{max} during the daytime hours and 40/50 dBA L_{eq}/L_{max} during the nighttime hours).

Additionally, construction activities may result in varying degrees of temporary groundborne noise and vibration, depending on the specific construction equipment used and activities involved. Groundborne noise and vibration levels caused by various types of construction equipment and activities (e.g., bulldozers, blasting) range from 58 – 109 VdB and from 0.003 – 0.089 in/sec PPV at 25 feet. Similar to the above discussion, although a detailed construction equipment list is not currently available, based on this project type it is expected that the primary sources of groundborne vibration and noise would include bulldozers and trucks. According to FTA, levels associated with the use of a large bulldozer and trucks are 0.089 and 0.076 in/sec PPV (87 and 86 VdB) at 25 feet, respectively. With respect to the prevention of structural damage, construction-related activities would not exceed recommended levels (e.g., 0.2 in/sec PPV). However, based on FTA's recommended procedure for applying a propagation adjustment to these reference levels, bulldozing and truck activities could exceed recommended levels with respect to the prevention of human disturbance (e.g., 80 VdB) within 275 feet.

Thus, implementation of reasonably foreseeable compliance responses could result in the generation of short-term construction noise in excess of applicable standards or that result in a substantial increase in ambient levels at nearby sensitive receptors, and exposure to excessive vibration levels.

Short-term construction-related impacts on noise associated with the Energy Sector could be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.a

The Regulatory Setting in Attachment 2 includes, but is not limited to, applicable laws and regulations that pertain to noise. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that could be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a "project" under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize noise include:

- Proponents of new or modified facilities constructed under the reasonably foreseeable compliance responses would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen the environmental impacts of the project. The definition of actions required to mitigate potentially significant noise impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
- Ensure noise-generating construction activities (including truck deliveries, pile driving and blasting) are limited to the least noise-sensitive times of day (e.g., weekdays during the daytime hours) for projects near sensitive receptors.
- Consider use of noise barriers, such as berms, to limit ambient noise at property lines, especially where sensitive receptors may be present.
- Ensure all project equipment has sound-control devices no less effective than those provided on the original equipment.
- All construction equipment used would be adequately muffled and maintained.
- Consider use of battery powered forklifts and other facility vehicles.
- Ensure all stationary construction equipment (i.e., compressors and generators) is located as far as practicable from nearby sensitive receptors or shielded.
- Properly maintain mufflers, brakes and all loose items on construction- and operation-related-related vehicles to minimize noise and address operational safety issues. Keep truck operations to the quietest operating speeds. Advise about downshifting and vehicle operations in sensitive communities to keep truck noise to a minimum.
- Use noise controls on standard construction equipment; shield impact tools.
- Consider use of flashing lights instead of audible back-up alarms on mobile equipment.
- Install mufflers on air coolers and exhaust stacks of all diesel and gas-driven engines.
- Equip all emergency pressure relief valves and steam blow-down lines with silencers to limit noise levels.
- Contain facilities within buildings or other types of effective noise enclosures.
- Employ engineering controls, including sound-insulated equipment and control rooms, to reduce the average noise level in normal work areas.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is

inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or reconstruction of existing facilities associated with the Energy Sector could be **potentially significant and unavoidable**.

Long-Term Operational Impact

Compliance responses associated with the Energy Sector could include: ZNE design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns), and construction of new energy storage facilities, and small modifications to oil and gas pipelines (e.g., valves). Development of these projects would likely occur within footprints of existing facilities, and within areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Development projects within manufacturing or industrial use areas are not anticipated to expose receptors to substantially increased operational noise levels.

However, though generally sited in rural areas, wind turbine farms, when in motion, emit a perceptible sound. This sound is generated from the wind turbine at points near the hub or nacelle, from the blade tips as they rotate, and transformers near ground level. The level of operational noise varies with the speed of the turbine blades, meteorological conditions, terrain, and the distance of the listener from the turbine. Due to technological advancements (e.g., upwind versus downwind rotor placement, low-noise gearboxes, insulated nacelles, pitch-control rotors, vibration-isolated mechanical equipment, and variable speed operation), typical noise level of wind turbines have decreased. These technologies have helped to alter noise to be more broadband in nature, rather than whines, whirrs, buzzes, hums, and thumping, which are the types of noises commonly associated with noise-related concerns.

Recent studies associated with wind turbines have been related to infrasound effects. Infrasound is sound that is lower in frequencies than the normal limit of human hearing (20 hertz). According to the Chief Medical Officer of Health of Ontario, there is no compelling evidence that infrasound adversely effects humans. The report states that low-frequency sounds and infrasounds are extremely common in the environment, and

are emitted from various sources, including wind, rivers, road traffic, aircraft, and ventilation systems. In addition, the study find that while some people living near wind turbines report symptoms such as dizziness, headaches, and sleep disturbances, there are not direct causal links between the wind turbine noise and adverse health effects (Chief Medical Officer of Health of Ontario 2012).

Regardless of these results, people may find the sound of wind turbines to be annoying. To determine the potential noise impacts at nearby residences from wind turbine operations, sound level data would need to be assessed on a project-by-project basis. Whether the turbine noise is intrusive would depend on various siting factors, in additional to background noise, which varies with the level of human and animal activities, as well as meteorological conditions (e.g., wind speed). However, the potential to affect people remains unknown, and siting locations and other requirements are under individual county jurisdiction (with the exception of requirements under Cal. Gov. Code, tit. 7, § 68593 et. seq.).

Long-term operational impacts on noise associated with the Energy Sector could be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.a (2)

The Regulatory Setting in Attachment 2 includes, but is not limited to, applicable laws and regulations that pertain to noise. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that could be approved by local jurisdictions or State agencies. The ability to require such measures is under the purview of jurisdictions or State agencies with land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. The following mitigation measures are recommended to reduce potential noise impacts.

The proponents for a proposed wind turbine farm project will prepare a noise study to assess the operational effects of proposed wind turbines on nearby receptors. This study should consider local noise ordinances, and determine methods to comply with these ordinances in the case that levels could be exceeded. Mitigation options that may be considered include: revising turbine layout, nighttime curtailment of select turbines, utilizing an alternate turbine manufacturer, and implementation of noise reduction technology (e.g., installation of adaptive control to control rotation speed and blade pitch, night-time shutdowns).

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant long-term operational impact on noise associated with the recommended actions in the Energy Sector could be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 13.b

Short-Term Construction-Related Impacts

There are four major types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related impacts on noise associated with the Transportation Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.b: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or modification of existing facilities associated with the Transportation Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impact

The recommended actions associated with the Transportation Sector could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrids, plug-in hybrid electric, battery electric vehicles, and fuel cell vehicles, could require development of new and/or modified manufacturing plants. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location of any new facilities or modification of existing facilities.

However, development projects would likely occur within footprints of existing facilities, areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Thus, implementation of any new regulations would not be anticipated to result in modifications near existing public (or public use) airports or private airstrips. No substantial increases in noises are anticipated.

Long-term operational noise impacts associated with the Transportation Sector would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 13.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used

in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands. Furthermore, modifications would occur in rural areas, not in close proximity to sensitive receptor. Potential modifications to existing facilities are not anticipated to substantially increase noise levels.

Thus, short-term construction-related and long-term operational noise impacts under the Agriculture Sector would be **less than significant**.

d) Water Sector

Impact 13.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities. The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a for the Energy Sector.

The types of construction-related impacts, associated with the Water Sector, on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related impacts on noise would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.d: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impact

Reasonably foreseeable compliance responses associated with the Water Sector include increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Development projects would likely occur within footprints of existing facilities, areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Thus, implementation of any new regulations would not be anticipated to result in modifications near existing public (or public use) airports or private airstrips. No substantial increases in noises are anticipated.

Long-term operational noise impacts associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 13.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as

increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related impacts on noise would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.e: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or modification of existing facilities associated with the Waste Management Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impact

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

Development projects would likely occur within footprints of existing facilities, areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Thus, implementation of any new regulations would not be anticipated to result in modifications near existing public (or public use) airports or private airstrips. No substantial increases in noises are anticipated.

Long-term operational noise impacts associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 13.f

Short-Term Construction-Related and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown. Even though they would likely be sited in locations of appropriate zoning, new facilities associated with this sector (e.g., biomass) could have exterior noise sources associated with operations (e.g., heavy duty equipment for biomass transfer and conveyors) which in some cases could be elevated, making it less likely the other structures would break the line-of-sight between the sources and receptors.

The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related and long-term operational effects on noise associated with the Natural and Working Land Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.f: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is

inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related and long-term operational impacts regarding noise resulting from the construction of new facilities or modification of existing facilities associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 13.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related impacts on noise associated with the Short-Lived Climate Pollutants Sector would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.g: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or modification of existing facilities associated with the Short-Lived Climate Pollutants Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impact

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them. Development projects would likely occur within footprints of existing facilities, areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Thus, implementation of any new regulations would not be anticipated to result in modifications near existing public (or public use) airports or private airstrips. No significant long-term operational impacts are anticipated.

Long-term operational noise impacts associated with the Short-Lived Climate Pollutant Sector would be **less than significant**.

h) Green Buildings

Impact 13.h

Short-Term Construction-Related Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar, wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

The types of construction-related impacts on noise would be of similar type and magnitude as those discussed under Impact 13.a under the Energy Sector.

Short-term construction-related impacts on noise associated with Green Buildings would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 13.h: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that

the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant short-term construction-related impact regarding noise resulting from the construction of new facilities or modification of existing facilities associated with Green Buildings would be **potentially significant and unavoidable**.

Long-Term Operational Impact

Compliance responses associated with Green Buildings would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar PV, wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

Development projects would likely occur within footprints of existing facilities, areas with zoning that would permit the development of manufacturing or industrial uses, or public lands where the appropriate State or federal agency has determined that such uses are allowable. Thus, implementation of any new regulations would not be anticipated to result in modifications near existing public (or public use) airports or private airstrips.

For the reasons described above under Impact 13.a, development of wind turbine farms could result in long-term operational noise impacts.

Long-term operational noise impacts associated with Green Buildings would be potentially significant.

This impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure: Implement Mitigation Measure 13.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant long-term operational impact on noise associated with the recommended actions in the Energy Sector could be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 13.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses that consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes involve construction which has the potential to introduce short-term noise levels that would exceed acceptable ambient levels. Because of the short-term nature of construction, and the industrial setting in which these noises would occur, this impact would be less than significant. Recognized measures exist that are implemented as standard practice to minimize construction noise.

Implementation of projects under the ODS Offset Protocol would not result in significant adverse noise impacts and is identified as less than significant. Implementation of projects under the Livestock Offset Protocol would allow the construction of digesters in agricultural settings. Construction of digesters could adversely impact sensitive receptors and is considered a significant and unavoidable impact. The FED recognized measures that exist to reduce this potential impact, but the authority to require project-specific mitigation lies with local permitting agencies and not ARB. Consequently, this impact is identified as significant and unavoidable. Projects implemented under the Urban Forest Offset Protocol would not produce unacceptable noise levels and is considered a less than significant impact. Projects implemented under the Forest Offset Protocol would occur in forested areas. Forest projects would produce elevated noise levels that exceed accepted ambient levels. However, adoption of the Forest Offset Protocol would not alter the extent of forest activities, but would simply shift some activities to projects that sequester carbon. Because the level of overall forest activities

would not change, the consequential noise impacts would not change. Thus, this impact is considered less than significant.

Impacts related to CCS are described above under the Energy Sector.

14. Population and Housing

a) Energy Sector

Impact 14.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of these new facilities would not be expected require new additional housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts on population growth, and displacement of housing or people associated with the Energy Sector would be **less than significant**.

b) Transportation Sector

Impact 14.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an

increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of these new facilities would not be expected require new additional housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts on population growth, and displacement of housing or people associated with the Transportation Sector would be **less than significant**.

c) Agriculture Sector

Impact 14.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of these new facilities would not be expected require additional new housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts under the Agriculture Sector associated with population growth, and displacement of housing or people would be **less than significant**.

d) Water Sector

Impact 14.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur.

The types of construction-related and long-term operational impacts on population and housing would be of similar type and magnitude as those discussed under Impact 14.a for the Energy Sector.

Therefore, short-term construction-related and long-term operational impacts on population growth, and displacement of housing or people associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 14.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of these new facilities would not be expected require additional new housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts on population growth, and displacement of housing or people associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 14.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands.

Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

Individual projects would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of new facilities would not be expected require additional new housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts on population growth, and displacement of housing or people associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 14.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of new facilities would not be expected require additional new housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction- and long-term operational impacts on population growth, and displacement of housing or people associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 14.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Operation of new facilities would not be expected require additional new housing or generate changes in land use that would conflict with adopted plans.

Therefore, short-term construction-related and long-term operational impacts on population growth, and displacement of housing or people associated with Green Buildings would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 14.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The Cap-and-Trade Regulation, including implementation of offset projects under the compliance offset protocols would not result in significant adverse impacts to employment, population, or housing. All impacts to population, employment, and housing would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

15. Public Services

a) Energy Sector

Impact 15.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy

storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction-related and long-term operational impacts, associated with the Energy Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

b) Transportation Sector

Impact 15.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities. However, these would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction- and long-term operational impacts, associated with the Transportation Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 15.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands. In addition, implementation of recommendations associated with the Agriculture Sector would not be expected to increase population levels, such that public services are affected.

As a result, short-term construction-related and long-term operational impacts, associated with the Agriculture Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

d) Water Sector

Impact 15.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction-related and long-term operational impacts, associated with the Water Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

e) Waste Management Sector

Impact 15.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction-related and long-term impacts, associated with the Waste Management Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

f) Natural and Working Lands Sector

Impact 15.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning. These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction-related and long-term impacts, associated with the Natural and Working Lands Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 15.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction and operational activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction- and long-term impacts, associated with the Short-Lived Climate Pollutants Sector, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

h) Green Buildings

Impact 15.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration

would not occur and that a sufficient construction employment base would likely be available. Construction activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services.

As a result, short-term construction-related and long-term operational impacts, associated with Green Buildings, on response time for fire protection, police protection, schools, parks, and other facilities would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 15.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These projects would not increase the level of public services beyond that already provided to existing facilities and is considered a less-than-significant impact. Implementation of projects under the ODS Offset Protocol, the Livestock Offset Protocol, and the Urban Forest Protocol would not result in a need for an increased level of public services beyond that already provided to existing facilities. Implementation of projects under the Forest Offset Protocol would not alter the extent of forest activities, but would shift some activities to projects that sequester carbon. Because the level of overall forest activities would not change, the consequential need for public services would not change. Thus, this impact of all the offset protocols is considered less than significant.

Impacts related to CCS are described above under the Energy Sector.

16. Recreation

a) Energy Sector

Impact 16.a

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

These activities would likely occur within footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities associated with the Energy Sector would be **less than significant**.

b) Transportation Sector

Impact 16.b

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions

and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations.

These activities would likely occur within footprints of existing manufacturing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities associated with the Transportation Sector would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 16.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms.

These activities would likely occur within footprints of existing manufacturing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially

deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities associated with the Agricultural Sector would be **less than significant**.

d) Water Sector

Impact 16.d

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

These activities would likely occur within footprints of existing manufacturing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially

deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational effects on regional parks or other recreational facilities, associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 16.e

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

These activities would likely occur within footprints of existing manufacturing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational effects on regional parks or other recreational facilities associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 16.f

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also

involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs. These actions are not anticipated to affect recreational facilities.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities).

While potential locations for these facilities are currently unknown, these activities would likely occur within footprints of existing manufacturing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 16.g

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

Demand for construction crews to build these facilities would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional

population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities, associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Building Sector

Impact 16.h

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

These activities would likely occur within footprints of existing facilities, or in areas with appropriate zoning. In addition, demand for these crews would be temporary (e.g., 6 – 12 months per project) and would not be anticipated to substantially increase regional population levels. Construction and operational activities associated with reasonably foreseeable compliance responses would not be anticipated to result in increased use of regional parks and other recreational facilities, such that existing neighborhood and regional parks or other recreational facilities would be substantially deteriorated. In addition, because construction crews would be temporary, and facilities would likely require few employees to run new or modified facilities, the demand for new (or expansion of) recreational-related facilities is not anticipated, and no substantial operational recreation impacts would be expected.

Therefore, short-term construction-related and long-term operational impacts on regional parks or other recreational facilities would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 16.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These actions would have a less than significant impact on recreation resources.

Implementation of projects under the ODS Offset Protocol, the Livestock Offset Protocol, the Urban Forest Offset Protocol would result in a less than significant impact on recreation resources. Implementation of projects under Forest Offset Protocol would involve forest management activities that could disrupt opportunities for forest recreation, but such disruptions exist under current conditions. Offset projects developed under the Forest Offset Protocol would include the construction of roads, temporary closures for tree installation and periodic increases in truck or construction equipment traffic that could disrupt recreational activities, but these forest projects developed under the Forest Offset Protocol would occur on land that was historically forested or currently forested, and consequently, the overall impact to recreational resources would be less than significant.

Impacts related to CCS are described above under the Energy Sector.

17. Transportation and Traffic

a) Energy Sector

Impact 17.a

Short-Term Construction-Related Impacts

Implementation of recommended actions under the Energy Sector could result in projects ranging from increased maintenance activities to large-scale renewable energy projects. Compliance responses could include: zero-net-energy design standards for homes and business, demand-response programs, distributed renewable energy

generation, CHP systems, CCS facilities, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground caverns) or construction of new energy storage facilities, installation of new pipelines and other subterranean components, and small modifications to oil and gas pipelines (e.g., valves).

Although detailed information about potential specific construction activities is not currently available, it would be anticipated to result in short-term construction traffic (primarily motorized) from worker commute- and material delivery-related trips. The amount of construction activity would vary depending on the particular type, number, and duration of usage for the varying equipment, and the phase of construction. These variations would affect the amount of project-generated traffic for both worker commute trips and material deliveries. Depending on the amount of trip generation and the location of new facilities, implementation could conflict with applicable programs, plans, ordinances, or policies (e.g., performance standards, congestion management); and/or result in hazardous design features and emergency access issues from road closures, detours, and obstruction of emergency vehicle movement, especially due to project-generated heavy-duty truck trips.

As a result, transportation and traffic impacts during construction projects associated with the Energy Sector would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB and not within its purview.

Mitigation Measure 17.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations in regards to transportation. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize construction traffic impacts include:

- Proponents of new or modified facilities constructed would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements

(e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.

- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen potentially significant impacts on traffic and transportation. The definition of actions required to mitigate potentially significant traffic impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
    - Minimize the number and length of access, internal, service and maintenance roads and use existing roads when feasible.
    - Provide for safe ingress and egress to/from the proposed project site. Identify road design requirements for any proposed roads, and related road improvements.
    - If new roads are necessary, prepare a road siting plan and consult standards contained in federal, State, or local requirements. The plans should include design and construction protocols to meet the appropriate roadway standards and be no larger than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Access roads should be located to avoid or minimize impacts to washes and stream crossings, follow natural contours and minimize side-hill cuts. Roads internal to a project site should be designed to minimize ground disturbance. Excessive grades on roads, road embankments, ditches, and drainages should be avoided, especially in areas with erodible soils.
    - Prepare a Construction Traffic Control Plan and a Traffic Management Plan.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Energy Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Energy Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Energy Sector would be **less than significant**.

b) Transportation Sector

Impact 17.b

Short-Term Construction-Related Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems. These recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts associated with construction impacts on performance of circulation systems; congestion management programs, air traffic patterns; hazards; emergency access, policies, plans, and programs would be of similar type and magnitude as those discussed under Impact 17.a. above. This impact would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.b: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Transportation Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Transportation Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Energy Sector would be **less than significant**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 17.c

Short-Term Construction-Related Impacts and Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial conversion of agriculture or forest lands. Therefore, the recommended actions in the Agriculture Sector would result in **less-than-significant** construction-related and operational impacts.

d) Water Sector

Impact 17.d

Short-Term Construction-Related Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of construction-related impacts on transportation and traffic would be of similar type and magnitude as those discussed under Impact 16.a for the Energy Sector.

Transportation and traffic impacts during construction projects associated with the Water Sector would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.d: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Water Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Water Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Water Sector would be **less than significant**.

e) Waste Management Sector

Impact 17.e

Short-Term Construction-Related Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills.

The types of impacts associated with construction impacts on performance of circulation systems; congestion management programs, air traffic patterns; hazards; emergency access, policies, plans, and programs would be of similar type and magnitude as those discussed under Impact 17.a, above.

Transportation and traffic impacts during construction projects associated with the Waste Management Sector would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.e: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Waste Management Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Waste Management Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Waste Management Sector would be **less than significant**.

f) Natural and Working Lands Sector

Impact 17.f

Short-Term Construction-Related Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory. In addition, planning efforts within and across jurisdictions would aim to create interconnected land areas and ecosystems throughout urban, natural and working lands, and agricultural croplands. Compliance responses associated with the Natural and Working Land Sector could also involve coordination with state agencies including: CNRA, CalEPA, OPR, CDFA, CalFire, BOF, CDFW, and ARB to develop land use programs. These programs would generally be designed to increase urban forest canopy cover and limit the conversion of croplands, forests, rangeland, and wetlands to urban uses. In addition, efforts could be made to increase the use of green infrastructure. Green infrastructure uses vegetation and soils to manage stormwater runoff, with technology such as rainwater harvesting, bioswales, permeable pavement, and green (i.e., growing media and vegetation) roofs.

In addition to land use planning efforts, incentives could be created to encourage the use of urban, agricultural, and forest wastes to produce electricity and transportation fuels. In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning.

The types of impacts associated with construction impacts on performance of circulation systems; congestion management programs, air traffic patterns; hazards; emergency access, policies, plans, and programs would be of similar type and magnitude as those discussed under Impact 17.a, above.

Transportation and traffic impacts during construction projects associated with the Natural and Working Lands Sector would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.f: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is

inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Natural and Working Lands Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Natural and Working Lands Sector would be **less than significant**.

g) Short-Lived Climate Pollutants Sector

Impact 17.g

Short-Term Construction-Related Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of impacts associated with construction impacts on performance of circulation systems; congestion management programs, air traffic patterns; hazards; emergency access, policies, plans, and programs would be of similar type and magnitude as those discussed under Impact 17.a, above.

Transportation and traffic impacts during construction projects associated with the Short-Lived Climate Pollutants Sector would be potentially significant. Implementation of the reasonably foreseeable compliance responses under this measure would not, however, result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.g: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with the Short-Lived Climate Pollutant Sector would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with the Short-Lived Climate Pollutants Sector would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with the Short-Lived Climate Pollutants Sector would be **less than significant**.

h) Green Buildings

Impact 17.h

Short-Term Construction-Related Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings could consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects.

New construction activities, including buildings, and renewable energy supply installations could be placed on land that is currently used for agricultural purposes. The types of impacts associated with construction impacts on performance of circulation systems; congestion management programs, air traffic patterns; hazards; emergency

access, policies, plans, and programs would be of similar type and magnitude as those discussed under Impact 17.a, above.

Transportation and traffic impacts during construction projects associated with Green Buildings would be potentially significant.

This impact on transportation and traffic could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 17.h: Implement Mitigation Measure 17.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact regarding traffic resulting from the construction of new facilities or modification of existing facilities associated with Green Buildings would be **potentially significant and unavoidable**.

Long-Term Operational Impacts

Implementation of the reasonably foreseeable compliance responses associated with Green Buildings would not result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Long-term operational impacts to transportation and traffic associated with Green Buildings would be **less than significant**.

i) Cap-and-Trade Regulation

Impact 17.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations

and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

Implementation of covered entity compliance responses is not expected to result in significant adverse impacts to transportation or traffic. If a facility expands or requires construction to take place, increases in construction traffic would be temporary and considered less than significant. Construction traffic impacts can be mitigated through ingress and egress controls, traffic controls, and reduced speed zones to address safety.

Activities undertaken to develop offset projects would be expected to vary according to the type of offset project. Transportation and traffic impacts resulting from the implementation of projects under the ODS Protocol, Urban Forest Protocol, and Forest Offset Protocol are considered to be less than significant. Construction of livestock digesters under the Livestock Offset Protocol could require the operation of heavy equipment on rural roads, potentially creating unsafe conditions. The FED identified recognized measures that exist to reduce this potentially significant impact, but the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects. Further, the programmatic analysis does not allow project-specific details of mitigation, resulting in an inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, the FED took the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that this impact may be potentially significant and unavoidable.

Impacts related to CCS are described above under the Energy Sector.

18. Utilities and Service Systems

Utilities and Service Systems impacts are inherently long-term and related to the operational facilities; thus, short-term construction-related impacts are not discussed below.

a) Energy Sector

Impact 18.a

Long-Term Operational Impacts

Compliance responses could include: zero-net-energy design for homes and business, demand-response programs, distributed renewable energy generation, CHP systems, energy storage technologies, smart grid and microgrid systems, and upgrades to oil and gas production, processing, storage, distribution, and transmission systems. Construction projects associated with these compliance responses could include various facilities, such as solar PV and wind turbine farms, new CHP facilities or retrofits of existing CHP facilities, modification to existing structures (e.g., dams, underground

caverns) or construction of new energy storage facilities, and small modifications to oil and gas pipelines (e.g., valves).

Because heavy cloud cover and too high/low winds cannot be predicted with a high level of certainty, wind and solar power must be fully backed up with peaking power supply capacity such as natural gas. Similar to adjusting and balancing power grid's supply-demand when 'on-demand' customers significantly change their power usage (without notification or constraints), the loss or gain of wind and solar power must be similarly controlled by adjusting peaking power generation capacities. Thus, while renewable energy sources could reduce some demand from power plants, without viable energy storage systems, additional, long-term backup power sources would be required to provide energy to homes and business that use renewable energy supplies. For the purposes of this analysis, it can be assumed that back up energy supplies would be incorporated into proposed projects, and would be subject to individual CEQA review, ensuring that adequate electricity loads would be available to serve the project.

However, newly constructed or modified facilities could generate substantial increases in the demand for water supply, wastewater treatment, storm water drainage, and solid waste services in their local areas. Any new or modified facilities, no matter their size and location would be required to seek local or State land use approvals prior to their development. In addition, part of the land use entitlement process for facilities proposed in California requires that each of these projects undergo environmental review consistent with the requirements of CEQA and the State CEQA Guidelines. It is assumed that facilities proposed in other states would be subject to comparable federal, state, and/or local environmental review requirements (e.g., CEQA) and that the environmental review process would assess whether adequate utilities and services (i.e., wastewater services, water supply services, solid waste facilities) would be available and whether the project would result in the need to expand or construct new facilities to serve the project. Through the environmental review process, utility and service demands would be calculated, agencies would provide input on available service capacity and the potential need for service-related infrastructure including expansions to waste water treatment plants, new water supply entitlements and infrastructure, storm water infrastructure, and solid waste handling capacity (e.g., landfills). Resulting environmental impacts would also be determined through this process.

At this time, the specific location and type of construction needs is not known and would be dependent upon a variety of market factors that are not within the control of ARB including: economic costs, product demands, environmental constraints, and other market constraints. Thus, the specific impacts from construction on utility and service systems cannot be identified with any certainty, and individual compliance responses could potentially result in significant environmental impacts for which it is unknown whether mitigation would be available to reduce the impacts. Thus, long-term operational impacts on utilities and service systems associated with the Energy Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.a

The Regulatory Setting in Attachment 2 includes applicable laws and regulations that relate to utilities and service systems. ARB does not have the authority to require implementation of mitigation related to new or modified facilities that would be approved by local jurisdictions. The ability to require such measures is under the purview of jurisdictions with local or State land use approval and/or permitting authority. New or modified facilities in California would qualify as a “project” under CEQA. The jurisdiction with primary approval authority over a proposed action is the Lead Agency, which is required to review the proposed action for compliance with CEQA statutes. Project-specific impacts and mitigation would be identified during the environmental review by agencies with project-approval authority. Recognized practices that are routinely required to avoid and/or minimize utility and service-related impacts include:

- Proponents of new or modified facilities constructed as a result of reasonably foreseeable compliance responses would coordinate with local or State land use agencies to seek entitlements for development including the completion of all necessary environmental review requirements (e.g., CEQA). The local or State land use agency or governing body would certify that the environmental document was prepared in compliance with applicable regulations and would approve the project for development.
- Based on the results of the environmental review, proponents would implement all mitigation identified in the environmental document to reduce or substantially lessen potentially significant impacts on utilities and service systems. The definition of actions required to mitigate potentially significant utility or service-related impacts may include the following; however, any mitigation specifically required for a new or modified facility would be determined by the local lead agency.
    - Comply with local plans and policies regarding the provision of water supply, wastewater treatment, and storm water drainage utilities, and solid waste services.
    - Where an on-site wastewater system is proposed, submit a permit application to the appropriate local jurisdiction.
    - Where appropriate, prepare a Water Supply Assessment (WSA) consistent with the requirements of Section 21151.9 of the Public Resources Code/ Section 10910 et seq. of the Water Code. The WSA would be approved by the local water agency/purveyor prior to construction of the project.
    - Comply with local plans and policies regarding the provision of wastewater treatment services.

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that

the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially impact to utilities and service systems resulting from the operation of new facilities associated with the Energy Sector would be **potentially significant and unavoidable**.

b) Transportation Sector

Impact 18.b

Long-Term Operational Impacts

There are four types of recommended actions associated with the Transportation Sector: (1) improve vehicle efficiency and develop zero emission technologies; (2) reduce the carbon content of fuels and provide market support to encourage the use of these fuels; (3) plan for and implement communities to reduce vehicular GHG emissions and provide more transportation options; and, (4) improve the efficiency and throughput of existing transportation systems.

Reasonably foreseeable compliance responses associated with the Transportation Sector could include infrastructure to support clean vehicles may be required, such as charging infrastructure. This type of infrastructure could result in increased demand for electricity and increase load in specific locations. Any new charging facilities are likely to be located within close proximity to existing electrical infrastructure (e.g., within parking lots and residences). New or modified utility installation, connections, and expansion would be subject to the requirements of the applicable utility providers.

The charging of BEVs and ZEVs has the potential for both positive and negative effects to the electric grid. The timing of charging is a key determining factor. For residential charging, the general case is that the EV changing will typically begin after drivers arrive home. National Personal Transportation Survey data indicate that the peak arrive time is 5-6 p.m.; however, only about 12 percent of vehicles arrive home during this hour, leading to a distribution of charging onset times. This results in an effective peak charging load of about 700 watts per vehicle. Thus, while residential charging power levels vary from about 1.4 to 7.7 kW, the average effect of a single vehicle on the electric system is far lower. There are significant efforts underway to alter the load shape generated by vehicle charging, whether by use of electricity pricing incentives, actively managed or smart charging, or onboard programming of charging times. These would have the effect of moving the load off the peak. At a system level, due to diversity, the electricity demand of these types of vehicles is relatively low, resulting in minimal effects to utility generation and transmission assets, particularly in the near term. According to the Electric Power Research Institute, the potential stresses on the

electric grid can be avoided through asset management, system design practices, and managed charging to shift a significant amount of the load away from system peak (Electric Power Research Institute 2011).

However, recommended actions could result in an increased demand for, and associated manufacturing of, a variety of alternative fuel and/or zero-emission technologies. Increased demand for products, such as standard hybrid, plug-in hybrid electric, battery electric, and fuel-cell vehicles and trucks, could require development of new and/or modified manufacturing plants. In addition, fixed-guideway systems to transport shipment containers may be installed at marine ports and near dock railyards. Infrastructure to support clean vehicles may be required, such as charging infrastructure and alternative fueling stations. Although it is reasonably foreseeable that activities associated with new or modified facilities could occur, there is uncertainty as to the exact location or character of any new facilities or modification of existing facilities.

The types of impacts related to water supply, wastewater treatment, and stormwater, and solid waste infrastructure associated with operation of new facilities would be of similar type and magnitude as those discussed under Impact 18.a, associated with the Energy Sector.

Thus, long-term operational impacts on utilities and services systems, associated with the Transportation Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.b: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with the Transportation Sector would be **potentially significant and unavoidable**.

Impacts related to CCS are described above under the Energy Sector.

c) Agriculture Sector

Impact 18.c

Long-Term Operational Impacts

Compliance responses associated with the Agriculture Sector would incentivize onsite management practices, and increase conservation efforts for agricultural and forest lands. Addressing regulatory limitations associated with the use of digester biogas used in natural gas pipelines and bioenergy used to supply the electricity grid could result in the installation of new equipment within existing farms. However, these would likely constitute minor modifications to existing facilities, and not result in substantial increased demand for water supply, wastewater treatment, stormwater, or solid waste infrastructure. In addition, additional utility capacity would not be expected under these recommended actions.

Thus, long-term operational impacts on utilities and service systems associated with the Agriculture Sector would be **less than significant**.

d) Water Sector

Impact 18.d

Long-Term Operational Impacts

The Proposed Update includes three types of recommended actions to reduce water-related energy use and associated GHG emissions in the Water Sector: (1) prioritizing investments in conservation; (2) adopting rate structures and pricing that maximize conservation; and (3) promoting less energy-intensive water management, such as a comprehensive groundwater policy. Rates could be adjusted through financial and regulatory incentives to promote widespread adoption of strong and equitable price signals to maximize conservation. These incentives could be made available within State grants and loans, or through applicable regulatory relief processes, such as water rights applications.

Reasonably foreseeable compliance responses associated with the recommended actions in the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

These actions could result in the reasonably foreseeable compliance responses of increased development of water resource facilities, such as water recycling facilities, detention structures for reuse of stormwater, and wastewater treatment-related capture of biogas for energy use. Development of new and/or modified recycled water and wastewater plants could occur. Although it is reasonably foreseeable that construction activities associated with new or modified facilities could occur, there is uncertainty as to

the exact location or character of any new facilities or modification of existing facilities. Compliance responses associated with the Water Sector primarily relate to the development of policies, guidance, and funding plans. These plans would generally aim to provide energy conservation and efficiency measures associated with water supply, conservation, water recycling, stormwater reuse, and wastewater-to-energy goals. Projects could include rate adjustments, investments in conservation, and water management policies.

The types of long-term operational impacts on utilities and service systems would be of similar type and magnitude as those discussed under Impact 18.a for the Energy Sector.

Thus, long-term operational impacts on utilities and service systems associated with the Water Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.d: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the local or State land use and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with the Water Sector would be **potentially significant and unavoidable**.

e) Waste Management Sector

Impact 18.e

Long-Term Operational Impacts

Implementation of the Waste Management recommendations in the Proposed Update could require construction of new, or expansion of existing, composting and anaerobic digestion facilities. These facilities would be necessary to accommodate actions such as increased recycling and anaerobic digestion facilities. In addition, existing and new facilities could result in installation of new CH_4 control devices at landfills. The recommended actions under the Waste Management Sector would generally reduce the rate at which landfills reach capacity, which may provide benefits to some facilities.

The types of impacts related to water supply, wastewater treatment, and stormwater infrastructure associated with new facilities would be of similar type and magnitude as those discussed under Impact 18.a, associated with the Energy Sector.

Thus, long-term operational impacts on utilities and service systems associated with the Waste Management Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.e: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the local or State land use and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with the Waste Management Sector would be **potentially significant and unavoidable**.

f) Natural and Working Lands Sector

Impact 18.f

Long-Term Operational Impacts

Recommended actions under the Proposed Update include addressing data gaps in California's inventory for natural and working lands, particularly with respect to carbon flux in rangelands and development of a wetlands inventory.

In addition, recommendations for the Natural and Working Lands Sector could cause an increase in the construction of facilities that would be used to convert urban, agricultural, and forest wastes into electricity and transportation fuels (e.g., biomass facilities). Furthermore, construction of new energy supply operations could require new energy transmission facilities and other infrastructure. The location and size of potential facilities is currently unknown; however, it is likely that they would be sited in locations of appropriate zoning.

The types of impacts related to water supply, wastewater treatment, and stormwater, and solid waste infrastructure associated with new facilities would be of similar type and magnitude as those discussed under Impact 18.a, associated with the Energy Sector.

Long-term operational impacts on utilities and service systems associated with the Natural and Working Lands Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.f: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the local or State land use and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with the Natural and Working Lands Sector would be **potentially significant and unavoidable**.

g) Short-Lived Climate Pollutants Sector

Impact 18.g

Long-Term Operational Impacts

The recommended actions and associated compliance responses in the Short Lived Climate Pollutants Sector could result in increased demand for new low-GWP compounds, and ODS destruction could result in new facilities to meet these needs. The location and size of these potential facilities is unknown; however, it is likely that they would be sited in locations that were appropriately zoned to accommodate them.

The types of impacts related to water supply, wastewater treatment, and stormwater, and solid waste infrastructure associated with new facilities would be of similar type and magnitude as those discussed under Impact 18.a, associated with the Energy Sector.

Long-term operational construction-related impacts on utilities and service systems associated with the Short-Lived Climate Pollutants Sector would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.g: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the local or State land use and/or permitting agency for individual

projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with the Short-Lived Climate Pollutants would be **potentially significant and unavoidable**.

h) Green Buildings

Impact 18.h

Long-Term Operational Impacts

The Proposed Update includes actions for Green Buildings that include development of a comprehensive GHG emission reduction program for new construction, building retrofits, and operation and maintenance of certified green buildings. Compliance responses associated with Green Buildings would consist of new requirements that would likely result in an increase in ZNE and zero-net-carbon buildings. This could be accomplished through increased carbon sequestering features (e.g., urban forestry), onsite renewable energy supplies (e.g., solar wind turbines, waste digesters), fuel cells, and construction of carbon offset technologies, including solar PV or wind turbine farms. These building components could be incorporated into new structures or added as part of building remodeling projects. In addition, utility-scale renewable energy projects may require additional infrastructure to distribute or generate energy supplies.

The types of impacts related to water supply, wastewater treatment, and stormwater, and solid waste infrastructure associated with new facilities would be of similar type and magnitude as those discussed under Impact 18.a, associated with the Energy Sector.

Long-term operational impacts on utilities and service systems associated with Green Buildings would be potentially significant.

This impact on utilities and service systems could be reduced to a less-than-significant level by mitigation that can and should be implemented by local or State lead agencies, but is beyond the authority of the ARB.

Mitigation Measure 18.h: Implement Mitigation Measure 18.a

Because the authority to determine project-level impacts and require project-level mitigation lies with the local or State land use and/or permitting agency for individual projects, and that the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts.

Consequently, while impacts could be reduced to a less-than-significant level by land use and/or permitting agency conditions of approval, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that the potentially significant impact to utilities and service systems resulting from the operation of new facilities associated with Green Buildings would be **potentially significant and unavoidable**.

i) Cap-and-Trade Regulation

Impact 18.i

The reasonably foreseeable compliance responses associated with a continued Cap-and-Trade Regulation would be the same as those actions described in the 2010 Cap-and-Trade FED. This includes continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and ODS Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. The impacts associated with implementation of offset projects under any additional compliance offset protocols would be analyzed and disclosed for public and Board consideration when the protocol is developed and proposed. For the continued implementation of the existing regulations and protocols, the environmental analysis in the 2010 Cap-and-Trade FED would apply to this component of the Proposed Update. Impacts described in the 2010 Cap-and-Trade FED are described as follows, and detailed in Attachment 3 of this EA.

The covered entity compliance responses consist of upgrading equipment, switching to lower intensity carbon fuels, and implementing maintenance and process changes. These projects would not increase the level of utilities beyond that already provided to existing facilities. Fuel switching could require provision of new services. The availability and extension of utilities is subject to approval of the local utility provider, and thus mitigated to less than significant.

Implementation of projects under the ODS Offset Protocol, Livestock Offset Protocol, and Urban Forest Offset Protocol would not result in a demand for a significant increase in the level of utilities or service systems that may serve existing sites. Construction of new facilities could require the incidental extension of utilities and services. The availability and extension of utilities is subject to approval of the local utility provider, and thus mitigated to less than significant.

Implementation of projects under the Forest Offset Protocol would not alter the extent of forest activities, but could increase forest projects to sequester carbon. Because the level of overall forest activities would not change, the consequential need for utility service systems associated with those activities would not change. Thus, this impact is considered less than significant.

Impacts related to CCS are described above under the Energy Sector.

5.0 CUMULATIVE AND GROWTH-INDUCING IMPACTS

A. Introduction

Cumulative impacts are impacts on the environment that result from the incremental impacts of a proposed project when added to other past, present, and reasonably foreseeable future actions. (Cal. Code Regs., tit. 14, § 15355(b).) Cumulative impacts can result from individually minor but collectively significant actions taking place over time.

Although the Air Resources Board (ARB) is exempt from the requirement to prepare environmental impact reports (EIRs), ARB followed the general guidance of the California Environmental Quality Act (CEQA) Guidelines for considering the cumulative impacts of implementation of the recommended actions included in the Proposed First Update to the Climate Change Scoping Plan First Update (Proposed Update). The CEQA Guidelines state that cumulative impacts should be addressed when the cumulative impacts are expected to be significant and when the project's incremental contribution to the impact is cumulatively considerable. (Cal. Code Regs., tit. 14, § 15130, subd. (a).) Section 15130 of the CEQA Guidelines states that the discussion of cumulative impacts need not provide as much detail as the discussion of impacts attributable to the project alone. Where a lead agency is examining a project with an incremental impact that is not "cumulatively considerable," a lead agency need not consider that impact significant, but must briefly describe its basis for concluding that the incremental impact is not cumulatively considerable.

Environmental impact reports (EIRs) must consider "other projects creating related impacts." (Cal. Code Regs., tit. 14, § 15130(a)(1).) CEQA Guidelines section 15355(b) requires an analysis of "other closely related past, present, and reasonably foreseeable probable future projects." However, due to the programmatic nature of this Environmental Analysis (EA), because of the statewide reach of the Proposed Update and the longer-term future horizon for the greenhouse gas (GHG) emission reduction achievements, the impact analysis for the resource topics in Chapter 4 is inherently cumulative in nature, rather than site or project specific as they pertain to reasonably foreseeable compliance responses to the recommended actions. As a result, the character of the impact conclusions in the resource-oriented sections of Chapter 4 are cumulative by considering the potential impacts of the full range of reasonably foreseeable compliance responses, along with expected background growth in California, as appropriate.

This section, therefore, summarizes the cumulative and growth-inducing impacts associated with the recommended actions in the Proposed Update for each resource topic evaluated in this EA.

B. Cumulative Impacts

1. Aesthetics

Implementation of the reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operational activities associated with new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. Construction and operation of these facilities (although likely to occur in areas zoned or used for manufacturing or industrial purposes), could conceivably introduce or increase the presence of artificial elements (e.g., heavy-duty equipment, removal of existing vegetation, buildings) in areas of scenic importance, such as visibility from a State scenic highways. The visual impact of such development would depend on several variables, including the type and size of facilities, distance and angle of view, visual absorption and placement in the landscape. In addition, facility operation may introduce substantial sources of glare, exhaust plumes, and nighttime glare from lighting for safety and security purposes. Implementation of mitigation measures would not reduce these impacts to a less-than-significant level because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects. Thus, implementation of the recommended actions in the Proposed Update could result in a considerable contribution to a cumulative aesthetics-related impact.

2. Agricultural and Forest Resources

Implementation of the reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could include construction and operational activities associated with new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. Construction of new facilities could result in the conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, Williamson Act conservation contracts, or forest land or timberland, resulting in the loss of these resources. Because ARB has no land use authority, mitigation is not within its purview to reduce potentially significant impacts to less-than-significant levels. Compliance with existing land use policies, ordinances, and regulations would serve to minimize this impact. Land use impacts would be further addressed for individual projects through the local development review process. Mitigation measures were identified that could reduce these impacts that would applied through the development review process. However, because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and because of the programmatic nature of this EA, impacts were determined to be potentially significant and unavoidable. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact to agricultural and forest resources.

3. Air Quality

Reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could result in an increase in criteria air pollutants (CAPs) and toxic air contaminants (TACs), as well as generate unpleasant odors that could affect sensitive receptors. These would be generated by the use of heavy-duty construction equipment on a short-term basis, as well as longer-term operational impacts associated with biomass, anaerobic digestion and composting facilities; and combustion of some higher biodiesel blends in certain diesel engines. Therefore, the Proposed Update could generate emission levels that conflict with applicable air quality plans, violate or contribute substantially to an existing or projected ambient air quality standard violation, result in a cumulatively considerable net increase in non-attainment areas, or expose sensitive receptors to substantial pollutant concentrations or odors. However, all projects, no matter their size or type would be required to seek local or State land use approvals prior to their implementation. Part of the land use entitlement process requires that each of these projects undergo environmental review consistent with California environmental review requirements (e.g., CEQA) and other applicable local requirements (e.g., local air district rules and regulations). This environmental review process would assess whether project implementation would result in short-term construction and long-term operational air quality impacts.

Implementation of mitigation measures could potentially reduce construction-related and long-term operational air quality impacts; however because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, and the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation. There is inherent uncertainty in the degree of mitigation that may ultimately by implemented to reduce potentially significant impacts.

Consequently, this EA takes the conservative approach in its post-mitigation significance conclusion and discloses, for CEQA compliance purposes, that construction-related and long-term operational air quality impacts resulting from the development of new facilities or modification of existing facilities could be potentially significant and unavoidable. Thus, the Proposed Update could result in a considerable contribution to a cumulative air quality impact.

4. Biological Resources

Implementation of reasonably foreseeable compliance responses could require construction and operational activities associated with new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. Construction could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. These activities would have the potential to adversely affect biological resources (e.g., species, habitat) that may reside or be present in those areas. Because

there are biological species that occur, or even thrive, in developed settings, resources could also be adversely affected by construction and operations within disturbed areas at existing manufacturing facilities or at other sites in areas with zoning that would permit the development of manufacturing or industrial uses.

The biological resources that could be affected by construction and operation associated with implementation of new regulations and/or incentive measures, would depend on the specific location of any necessary construction and its environmental setting. Harmful impacts could include modifications to existing habitat; including removal, degradation, and fragmentation of riparian systems, wetlands, or other sensitive natural wildlife habitat and plan communities; interference with wildlife movement or wildlife nursery sites; loss of special-status species; and/or conflicts with the provisions of adopted habitat conservation plans, natural community conservation plans, or other conservation plans or policies to protect natural resources. Implementation of mitigation measures would not reduce these impacts to a less-than-significant level. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact on biological resources.

5. Cultural Resources

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction activities associated with new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. Construction activities could require disturbance of undeveloped area, such as clearing of vegetation, earth movement and grading, trenching for utility lines, erection of new buildings, and paving of parking lots, delivery areas, and roadways. Demolition of existing structures may also occur before the construction of new buildings and structures. The cultural resources that could potentially be affected by ground disturbance activities could include, but are not limited to, prehistoric and historical archaeological sites, paleontological resources, historic buildings, structures, or archaeological sites associated with agriculture and mining, and heritage landscapes. Properties important to Native American communities and other ethnic groups, including tangible properties possessing intangible traditional cultural values, also may exist. Historic buildings and structures may also be adversely affected by demolition-related activities. Such resources may occur individually, in groupings of modest size, or in districts. Because culturally sensitive resources can also be located in developed settings, historic, archeological, and paleontological resources, and places important to Native American communities, could also be adversely affected by construction of new facilities. Implementation of mitigation measures could reduce these impacts, however because the authority to determine specific project-level impacts and mitigation is outside the purview of ARB, any mitigation identified would not reduce these impacts to a less-than-significant level. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact on cultural resources.

6. Energy Demand

Implementation of reasonably foreseeable compliance responses could require construction and operational activities associated with new or modified facilities or infrastructure. Temporary increases in energy demand associated with new facilities would include fuels used during construction, and gas and electric operational demands. Typical earth-moving equipment that may be necessary for construction includes: graders, scrapers, backhoes, jackhammers, front-end loaders, generators, water trucks, and dump trucks. While energy would be required to complete construction for any new or modified facilities or infrastructure projects, it would be temporary and limited in magnitude and would not result in sustained increases in demand that would adversely affect energy supplies. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative impact relative to construction-related energy demand.

However, long-term operational energy demand impacts associated with the recommended actions would be primarily beneficial, and thus no contributions to a cumulative impact on long-term operational energy demand would occur.

7. Geology and Soils

Implementation of the reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operational activities associated with new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. Construction and operation could be located in a variety of relatively high-risk geologic and soil conditions that are considered to be potentially hazardous. For instance, the seismic conditions at the site of a new facility may have high to extremely high seismic-related fault rupture and ground shaking potential associated with earthquake activity. New facilities could also be subject to seismic-related ground failure, including liquefaction and landslides. Construction and operational activities could be located in a variety of geologic, soil, and slope conditions with varying amounts of vegetation that would be susceptible to soil erosion. Strong ground shaking could also trigger landslides in areas where the natural slope is naturally unstable or is over-steepened by the construction of access roads and structures. Construction and operation could also occur in locations that would expose facilities and structures to expansive soil conditions. Development of new facilities could be susceptible to the presence of expansive soils particularly in areas of fine-grained sediment accumulation typically associated with playas, valley bottoms, and local low-lying areas.

The specific design details, siting locations, seismic hazards, and geologic, slope, and soil conditions for any particular facilities that could occur as a result of reasonably foreseeable compliance responses are not known at this time and would be analyzed on a site-specific basis at the project level. Therefore, for purposes of this analysis, development of these facilities could expose people and structures to relatively high levels of risk associated with strong seismic ground shaking, including liquefaction and

landslides, and instability. These geologic, seismic, and soil-related conditions could result in damage to structures, related utility lines, and access roads, blocking access and posing safety hazards to people.

Because the authority to determine project-level impacts and require project-level mitigation lies with the land use approval and/or permitting agency for individual projects, and since the programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact on geology and soils.

8. Greenhouse Gases

Implementation of reasonably foreseeable compliance responses could require construction activities associated with new or modified facilities or infrastructure. Specific, project-related construction activities could result in increased generation of short-term GHG emissions in limited amounts associated with the use of heavy-duty off-road equipment, materials transport, and worker commutes. As described in Chapter 4, a majority of local agencies (e.g., air pollution control districts) do not recommend or require the quantification of short-term construction-generated GHGs for typical construction projects because these only occur for a finite period of time (e.g., during periods of construction) that is typically much shorter than the operational phase, and agencies generally recommended that GHG analyses focus on operational phase emissions, unless the project is of a unique nature requiring atypical (e.g., large scale, long-term) activity levels (e.g., construction of a new dam or levee) for which quantification and consideration (e.g., amortization of construction emissions over the lifetime of the project) may be recommended. Thus, short-term construction related GHG emissions impacts associated with reasonably-foreseeable compliance responses for the recommended actions in the Proposed Update are considered less than significant when considered in comparison to the overall GHG reduction associated with implementation of the Proposed Update.

The long-term operational impacts to GHG emissions from the recommended actions are primarily beneficial, consistent with the goals and objectives of the Proposed Update to reduce emissions to achieve 2020 and post-2020 emission reduction goals.

Thus, the Proposed Update would not result in a considerable contribution to a cumulative GHG emissions impact.

9. Hazards and Hazardous Materials

Reasonably foreseeable compliance responses to the recommended actions in the Proposed Update could include construction and operation of new or modified facilities or infrastructure. There is uncertainty as to the exact locations where construction and operations of new facilities or the modification of existing facilities would occur.

Construction activities may require the transport, use, and disposal of hazardous materials. Construction activities generally use heavy-duty equipment requiring periodic refueling and lubricating. Large pieces of construction equipment (e.g., backhoes, graders) are typically fueled and maintained at the construction site. However, the transport, use, and disposal of hazardous materials would be required to comply with all applicable federal, State and local laws (see Attachment 2 of this EA). In addition, although there is uncertainty as to the exact locations where new facilities could be constructed or where existing facilities could be reconstructed, these would likely occur within footprints of existing manufacturing facilities, or in areas with zoning that would permit the development of manufacturing or industrial uses. As a result, construction-related impacts on hazards and hazardous materials would be less than significant.

In addition, because potential facilities would likely occur within footprints of existing manufacturing facilities, the Proposed Update would not be expected to result in locating new facilities near schools, public (or public use) airports, private airstrips, or wildlands; or on sites included on a list of hazardous materials sites or impair implementation of or physically interfere with an adopted emergency response or evacuation plan. In addition, as noted above, the handling of hazards materials would be required to comply with all applicable federal, State and local laws. As a result, operational impacts associated with the proposed on hazards and hazardous materials would be less than significant.

Therefore, because the Proposed Update would result in less-than-significant impacts, no contribution to a cumulative hazards or hazardous materials impact would occur.

10. Hydrology and Water Quality

Construction activities and long-term operations associated with reasonably foreseeable compliance responses to the recommended actions could be located in a variety of conditions with regards to altering drainage patterns, flooding, and inundation by seiche, tsunami, or mudflow. The level of susceptibility varies by location. The specific design details, siting locations, and associated hydrology and water quality issues are not known at this time and would be analyzed on a site-specific basis at the project level. Therefore, for purposes of CEQA disclosure, these potential hydrology and water quality-related impacts could be significant. Implementation of mitigation measures to reduce these impacts would not reduce these impacts to a less-than-significant level because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact to hydrology and water quality.

11. Land Use and Planning

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require both construction and long-term operation of new or modified facilities or infrastructure. There is uncertainty as

to the exact location of these new facilities or the modification of existing facilities. However, facilities would likely occur within the footprints of existing manufacturing facilities, or in areas with zoning that would permit the development these facilities. Thus, implementation of the recommended actions would not be anticipated to divide an established community or conflict with a land use or conservation plan. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative land use planning-related impact.

12. Mineral Resources

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require both the construction and operation of new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. New facilities would likely occur within existing footprints or in areas with consistent zoning, where original permitting and analyses considered these issues, and thus impacts to the availability of a known mineral resource or recovery site would be less than significant. Some of the recommended actions and associated compliance responses could require the extraction of minerals (i.e., lithium or platinum) used to manufacture fuel cell and battery technologies. However, implementation of these measures would not substantially deplete the supply of lithium or platinum and both are currently used in auto manufacturing processes. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative impact to mineral resources.

13. Noise

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operation of new or modified facilities or infrastructure. These activities could result in the generation of short-term construction noise in excess of applicable standards or that result in a substantial increase in ambient levels at nearby sensitive receptors, and exposure to excessive vibration levels, which would be potentially significant. Operational noise impacts would not typically be expected due to the fact that typical compliance response activities would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of these facilities. However, operational effects of equipment constructed as a result of implementation of recommended actions associated with the Energy Sector and Green Buildings could result in potentially significant impacts. Implementation of mitigation measures could reduce potential construction-related or operational noise impacts to a less-than-significant level; however, the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects. Thus, the Proposed Update could result in a considerable contribution to a cumulative construction-related noise impact.

14. Population and Housing

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operation of new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of such facilities. Construction of these facilities activities would require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, a substantial amount of construction worker migration would not be likely to occur, and a sufficient construction employment base would likely be available. Construction activities would not require new additional housing or generate changes in land use. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative impact related to population and housing growth.

15. Public Services

Reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could include construction and operation of new or modified facilities or infrastructure. There is uncertainty as to the exact location of these new facilities or the modification of existing facilities. These would likely occur within footprints of existing facilities, or in areas with zoning that would permit the development of these facilities. Construction activities would be anticipated to require relatively small crews, and demand for these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Construction activities would not require new additional housing to accommodate or generate changes in land use and, therefore, would not affect the provision of public services. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative impact related to public services.

16. Recreation

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operations of new or modified facilities or infrastructure. There is uncertainty as to the exact locations of potential new or modified facilities. These activities would likely occur within footprints of existing facilities, or in areas with zoning that would permit their development. In addition, demand for construction of these crews would be temporary (e.g., 6 – 12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Thus, construction activities associated with reasonably foreseeable compliance responses would not be anticipated to increase the use of existing neighborhood and regional parks or other

recreational facilities such that substantial physical deterioration would occur. In addition, the demand for new (or expansion of) recreational-related facilities would not occur as a result of construction activities. Therefore, the Proposed Update would not result in a considerable contribution to a cumulative impact related to recreational facilities.

17. Transportation and Traffic

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operations of new or modified facilities or infrastructure. Although detailed information about potential specific construction activities is not currently available, some of the potential compliance responses could result in short-term construction traffic (primarily motorized) from worker commute- and material delivery-related trips. The amount of construction activity would vary depending on the particular type, number, and duration of usage for the varying equipment, and the phase of construction. These variations would affect the amount of project-generated traffic for both worker commute trips and material deliveries. Depending on the amount of trip generation and the location of new facilities, implementation could conflict with applicable programs, plans, ordinances, or policies (e.g., performance standards, congestion management); and/or result in hazardous design features and emergency access issues from road closures, detours, and obstruction of emergency vehicle movement, especially due to project-generated heavy-duty truck trips. As a result, transportation and traffic impacts during construction projects associated with the Energy Sector would be potentially significant.

Implementation of the reasonably foreseeable compliance responses under this measure would not, however, result in substantial long-term operational changes in traffic patterns or vehicle trips, or conflict with existing circulation plans.

Implementation of mitigation measures could reduce short-term construction related impacts to a less-than-significant level, but because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects, the impacts are considered potentially significant and unavoidable. Thus, the Proposed Update could result in a considerable contribution to a cumulative transportation and traffic-related impact.

18. Utility Service Systems

Implementation of reasonably foreseeable compliance responses associated with the recommended actions in the Proposed Update could require construction and operations of new or modified facilities or infrastructure. Newly constructed or modified facilities could generate substantial increases in the demand for water supply, wastewater treatment, storm water drainage, and solid waste services in their local areas. Any new or modified facilities, no matter their size and location would be required to seek local or State land use approvals prior to their development. Part of the land use entitlement process for facilities proposed in California requires that each of these

projects undergo environmental review consistent with the requirements of CEQA and the State CEQA Guidelines. It is assumed that facilities proposed in other states would be subject to comparable federal, state, and/or local environmental review requirements (e.g., CEQA) and that the environmental review process would assess whether adequate utilities and services (i.e., wastewater services, water supply services, solid waste facilities) would be available and whether the project would result in the need to expand or construct new facilities to serve the project.

At this time, the specific location and type of construction needs is not known and would be dependent upon a variety of market factors that are not within the control of ARB including: economic costs, product demands, environmental constraints, and other market constraints. Thus, the specific impacts from construction on utility and service systems cannot be identified with any certainty, and individual compliance responses could potentially result in significant environmental impacts for which it is unknown whether mitigation would be available to reduce the impacts to a less-than-significant level.

Implementation of mitigation measures would not reduce these impacts to a less-than-significant level because the authority to determine project-level impacts and require project-level mitigation lies with land use and/or permitting agencies for individual projects. Thus, the Proposed Update could result in a considerable contribution to a cumulative impact with respect to utilities and service systems.

C. Growth-Inducing Impacts

As noted above, the Proposed Update would not directly result in any growth in population or housing. Recommended actions discussed in the Proposed Update will ultimately make California a better place to live. There is a possibility of encouraged growth via green jobs and innovative green technologies. California is renowned for its environmentally progressive laws and regulations, and the Proposed Update would contribute to California’s effort to improve public health, contribute towards healthy lifestyles and improved quality of life.

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6.0 MANDATORY FINDINGS OF SIGNIFICANCE

Consistent with the requirements of the California Environmental Quality Act (CEQA) Guidelines section 15065 and section 18 of the Environmental Checklist, this Environmental Analysis (EA) addresses the mandatory findings of significance for the recommended actions included in the Proposed First Update to the Climate Change Scoping Plan (Update).

A. Mandatory Findings of Significance

1. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat for a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?

Under CEQA Guidelines section 15065(a), a finding of significance is required if a project “has the potential to substantially degrade the quality of the environment.” In practice, this is the same standard as a significant impact on the environment, which is defined in CEQA Guidelines section 15382 as “a substantial or potentially substantial adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance.”

As with all of the environmental impacts and issue areas, the precise nature and magnitude of impacts would be highly variable, and would depend on a range of reasonably foreseeable compliance responses that could occur with implementation of the recommended actions in the Proposed Update. The locations of compliance responses, their spatial or aerial extent, and a variety of site-specific factors are not known at this time but would be addressed by environmental reviews to be conducted when specific regulations are proposed by statewide regulatory agencies, or by local or regional agencies with regulatory authority at the project-specific level.

This EA, in its entirety, addresses and discloses potential environmental impacts associated with the recommended actions in the proposed Update, including direct, indirect, and cumulative impacts in the following resource areas:

- Aesthetics
- Agriculture and Forest Resources
- Air Quality
- Greenhouse Gas Emissions
- Biological Resources
- Cultural Resources

- Energy Demand
- Geology and Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation/Traffic
- Utilities and Service Systems

As described in Chapter 4, this EA discloses potential environmental impacts, the level of significance prior to mitigation, mitigation measures, and the level of significance after the incorporation of mitigation measures.

a) Impacts on Species

Under CEQA Guidelines section 15065(a)(1), a lead agency shall find that a project may have a significant impact on the environment where there is substantial evidence that the project has the potential to (1) substantially reduce the habitat of a fish or wildlife species; (2) cause a fish or wildlife population to drop below self-sustaining levels; or (3) substantially reduce the number or restrict the range of an endangered, rare, or threatened species. Chapter 4 of this EA addresses typical construction impacts that could occur to biological resources, including the reduction of fish or wildlife habitat, the reduction of fish or wildlife populations, and the reduction or restriction of the range of special-status species.

b) Impacts on Historical Resources

CEQA Guidelines section 15065(a)(1) states that a lead agency shall find that a project may have a significant impact on the environment where there is substantial evidence that the project has the potential to eliminate important examples of a major period of California history or prehistory. CEQA Guidelines section 15065(a)(1) amplifies Public Resources Code section 21001(c) requiring that major periods of California history are preserved for future generations. It also reflects the provisions of Public Resources Code section 21084.1 requiring a finding of significance for substantial adverse changes to historical resources. CEQA Guidelines section 15064.5 establishes standards for determining the significance of impacts to historical resources and archaeological sites that are a historical resource. Chapter 4 of this EA addresses typical construction impacts that could occur related to California history and prehistory, historic resources, archaeological resources, and paleontological resources.

2. Does the project have impacts that are individually limited, but cumulatively considerable?

As required by CEQA Guidelines section 15065, a lead agency shall find that a project may have a significant impact on the environment where there is substantial evidence that the project has potential environmental impacts that are individually limited, but cumulatively considerable. As defined in CEQA Guidelines section 15065(a)(3), cumulatively considerable means "that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." Cumulative impacts are addressed for each of the environmental topics listed above and are provided in Chapter 5, "Cumulative and Growth-Inducing Impacts," in this EA.

3. Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Consistent with CEQA Guidelines section 15065(a)(4), a lead agency shall find that a project may have a significant impact on the environment where there is substantial evidence that the project has the potential to cause substantial adverse impacts on human beings, either directly or indirectly. Under this standard, a change to the physical environment that might otherwise be minor must be treated as significant if people would be significantly affected. This factor relates to adverse changes to the environment of human beings generally, and not to impacts on particular individuals. While changes to the environment that could indirectly affect human beings would be represented by all of the designated CEQA issue areas, those that could directly affect human beings include air quality, geology and soils, hazards and hazardous materials, hydrology and water quality, noise, population and housing, public services, transportation/traffic, and utilities, which are addressed in Chapter 4 of this EA.

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7.0 ALTERNATIVES ANALYSIS

This section provides an overview of the regulatory requirements and guidance for alternatives analyses under the California Environmental Quality Act (CEQA), a description of each of the alternatives to the proposed project (i.e., the Proposed First Update to the Climate Change Scoping Plan [Proposed Update]), a discussion of whether and how each alternative meets the project's objectives, and an analysis of each alternative's environmental impacts.

A. Approach to Alternatives Analysis

The Air Resources Board's (ARB) certified regulatory program (Cal. Code Regs., tit. 17, §§ 60000 – 60008) requires that where a contemplated action may have a significant effect on the environment, a staff report shall be prepared in a manner consistent with the environmental protection purposes of ARB's regulatory program and with the goals and policies of CEQA. Among other things, the staff reports must address feasible alternatives to the proposed action that would substantially reduce any significant adverse impact identified.

The regulation provides general guidance that any action or proposal for which significant adverse environmental impacts have been identified during the review process shall not be approved or adopted as proposed if there are feasible mitigation measures or feasible alternatives available which would substantially reduce such adverse impact. For purposes of this section, "feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors, and consistent with the state board's legislatively mandated responsibilities and duties. (Cal. Code Regs., tit. 17, § 60006.)

While ARB, by virtue of its certified program, is exempt from Chapters 3 and 4 of CEQA and corresponding sections of the State CEQA Guidelines, the Guidelines nevertheless contain useful information for preparation of a thorough and meaningful alternatives analysis. CEQA Guidelines section 15126.6(a) speaks to evaluation of "a range of reasonable alternatives to the project, or the location of the project, which would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects, and evaluate the comparative merits of the alternatives." The purpose of the alternatives analysis is to determine whether or not a different approaches to or variations of the project would reduce or eliminate significant project impacts, within the basic framework of the objectives, a principle that is consistent with ARB's regulatory requirements.

Alternatives considered in an environmental document should be potentially feasible and should attain most of the basic project objectives. It is, therefore, critical that the alternatives analysis define the project's objectives. In this case, the objectives are established by AB 32. Under AB 32, ARB is required to update the Scoping Plan "for achieving the maximum technologically feasible and cost-effective reductions of GHG

emissions at least once every five years." (Health & Saf. Code, § 38561, subd. (h).) The project objectives are described further below in Section C. of this Chapter.

The range of alternatives is governed by the "rule of reason," which requires evaluation of only those alternatives "necessary to permit a reasoned choice." (Cal. Code Regs., tit. 14, § 15126.6, subd. (f).) Further, an agency "need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative." (Cal. Code Regs., tit. 14, § 15126.6, subd. (f)(3).) The analysis should focus on alternatives that are feasible and that take economic, environmental, social, and technological factors into account. Alternatives that are remote or speculative need not be discussed. Furthermore, the alternatives analyzed for a project should focus on reducing or avoiding significant environmental impacts associated with the project as proposed.

B. Selection of Range of Alternatives

This chapter evaluates a reasonable range of alternatives to the Proposed Update that could reduce or eliminate the project's significant effects on the environment, while meeting most of the basic project objectives. (Cal. Code Regs., tit. 14, § 15126.6, subd. (a).) Pursuant to ARB's certified program, this chapter also contains an analysis of each alternative's feasibility and the likelihood that it will substantially reduce any significant adverse environmental impacts identified in the impact analysis contained in Chapter 4 of this EA. (Cal. Code Regs., tit. 17, §§ 60005(b), 60006.)

As described earlier, the Proposed Update builds upon the approach of the initial Scoping Plan by recommending a balanced mix of broad-based sector strategies and recommended actions for the State to ensure that California remains on track to meet the near-term 2020 GHG emissions limit and continues on a downward GHG emissions trajectory consistent with achieving the State's long-term climate stabilization objectives, while maintaining a vibrant, clean, and sustainable California economy. Likewise, suitable alternatives considered in this EA need also to be broad-based, comprehensive approaches that could meet the basic project objectives, while reducing or eliminating the project's significant effects on the environment.

While the Proposed Update recognizes the need for broad-based strategies that require continued changes to how the State generates, transmits, and consumes electricity; how people and goods are transported; how communities are planned and built; the conveyance, distribution and consumption of water and other resources; and the State's management of its vast natural and agrarian lands; however, specific actions are not yet fully defined at this stage of planning. The level of detail for each alternative must reflect that the project is a broad plan and, accordingly, the analysis cannot provide the level of detail that will be contained in subsequent environmental documents that would be prepared when each of the Proposed Update's recommended actions or regulations are subsequently developed and implemented by ARB or other lead agencies. (See Cal. Code Regs., tit. 14, §15152.)

ARB has identified a reasonable range of three alternatives that allow the public and Board to understand the differences between different approaches. GHG emission reduction measures ongoing or already implemented as part of the initial Scoping Plan are considered a part of the No-Project Alternative. Since these programs are already underway and reducing emissions at this time, they are reasonably expected to continue. ARB did not consider dismantling adopted components of the initial Scoping Plan (e.g., Advance Clean Cars Regulation, Cap-and-Trade Regulation) as feasible alternatives (or components of alternatives) to the Proposed Update because removing existing ongoing programs would be contrary to the basic project objective of reducing GHG emissions. In addition to the No Project Alternative, ARB made a good faith effort to identify other potentially feasible project alternatives. This included examining comments received at the public workshops held in June, July, and October of 2013, and at the Board hearings held in October 2013 and February 2014 to determine if any commenters suggested potentially feasible alternatives. While commenters made suggestions for particular components of recommended actions within the key economic sectors, no comments suggested an alternative, broad-based comprehensive approach to the project itself. ARB staff found no comments suggesting an alternative comprehensive approach to meet the State's long-term goals.

Despite the challenge of identifying alternative approaches to the project as a whole, rather than just alternatives to components within the project, ARB staff was able to identify two feasible action alternatives in addition to the No Project Alternative, a Reduced-Intensity Project Alternative, and Extending the Cap-and-Trade Regulation to All Economic Sectors Alternative. These are described more fully below. These alternatives to the project as a whole do not alter the basic nature of the project, while providing sufficient information to allow a comparison with the proposed project.

C. Project Objectives

The project objectives described in Chapter 2, Project Description, are summarized below. These objectives are derived from the requirements of AB 32. The analysis that follows in Section E of this chapter includes a discussion of the degree to which each alternative meets these basic project objectives.

1. To update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions at least once every five years (Health & Saf. Code, § 38561, subd. (h));

2. Pursue measures to maintain and continue reductions in emissions of GHG beyond 2020 (Health & Saf. Code § 38551(b));

3. Pursue measures that implement reduction strategies covering the state's GHG emissions in furtherance of California's mandate to reduce GHG emissions to 1990 levels by 2020;

4. Reduce fossil fuel use – to reduce California's reliance on fossil fuels and diversify energy sources while maintaining electric system reliability;

5. Design an enforceable, amendable program – to design a program that is enforceable and that is capable of being monitored and verified;

6. Ensure emission reductions – to pursue emissions reductions that are real, permanent, quantifiable, verifiable and enforceable;

7. Achieve technologically feasible and cost-effective reductions – to achieve the maximum technologically feasible and cost-effective reductions in GHG emissions, in furtherance of achieving the statewide GHG emissions limit (Health & Saf. Code, § 38562, subds. (a) and (c));

8. Avoid disproportionate impacts – to ensure, to the extent feasible, that activities undertaken to comply with the measures do not disproportionately impact low income communities (Health & Saf. Code, § 38562, subd. (b)(2));

9. Complement existing air standards – to ensure, to the extent feasible, that activities undertaken pursuant to the measures complement, and do not interfere with, efforts to achieve and maintain national and California Air Quality Attainment Standards and to reduce toxic air contaminant (TAC) emissions (Health & Saf. Code, § 38562, subd. (b)(4));

10. Consider a broad range of public benefits – to consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health (Health & Saf. Code, § 38562, subd. (b)(6));

11. Minimize administrative burden – to minimize, to the extent feasible, the administrative burden of implementing and complying with the measure (Health & Saf. Code, § 38562,subd. (b)(7));

12. Weigh relative emissions – to consider, to the extent feasible, the contribution of each source or category of sources to statewide emissions of GHGs (Health & Saf. Code, § 38562, subd. (b)(9));

13. Maximize co-benefits – to maximize, to the extent feasible, additional environmental and economic benefits for California, as appropriate (Health & Saf. Code, § 38570, subd. (b)(3)); and

14. Avoid duplication – to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements (Health & Saf. Code, § 3850, subd. (g) and § 38561, subd. (a)).

D. Description of Alternatives

Detailed descriptions of each alternative are presented below. The analysis that follows the descriptions of the alternatives includes a discussion of the degree to which each alternative meets the basic project objectives, and the degree to which each alternative avoids potentially significant impacts identified in Chapter 4.

1. Alternative 1: No-Project Alternative

a) Alternative 1 Description

ARB is including Alternative 1, the No-Project Alternative, to provide a good faith effort to disclose environmental information that is important for considering the Proposed Update. ARB's certified regulatory program does not mandate consideration of a "No-Project Alternative." (Cal. Code Regs., tit. 17, § 60006.) Under ARB's certified program, the alternatives considered, among other things, must be "consistent with the state board's legislatively mandated responsibilities and duties." (Cal. Code Regs., tit. 17, § 60006.)

Moreover, it is not clear that ARB would have legal authority to pursue the No-Project Alternative. ARB is legislatively mandated to update the Scoping Plan at least once every five years to achieve "the maximum technologically feasible and cost-effective reductions of GHG …." (Health & Saf. Code, § 38561, subd. (h).)

The No-Project Alternative is included only to assist in the analysis and consideration of this portion of the Proposed Update and the action alternatives. It is useful to include a "No-Project Alternative" in this analysis for the same reasons that this type of alternative is called for in the State CEQA Guidelines. As noted in the CEQA Guidelines, "the purpose of describing and analyzing a no-project alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project." (Cal. Code Regs., tit. 14, § 15126.6, subd. (e)(1).) The No-Project Alternative also provides an important point of comparison to understand the potential environmental benefits and impacts of the other alternatives.

Alternative 1 in this analysis describes a reasonably foreseeable scenario, if ARB did not approve the Proposed Update. Under this No-Project Alternative, those measures included in the initial Scoping Plan that are already being implemented, as well as those measures enacted under authority outside of AB 32, would continue to be implemented. For a complete description of the status of the initial Scoping Plan measures and related implementation efforts, please refer to the descriptions of each Scoping Plan sector contained in Chapter 4, section A.

The No-Project Alternative does not contemplate that there would be no further action by ARB or other state agencies related to the reduction of GHG emissions. Some of the recommended actions contained in the Proposed Update may occur as a result of subsequent regulatory actions by ARB or other agencies under separate statutory authority regardless of their inclusion in the Proposed Update.

b) Alternative 1 Impact Discussion

i) Objectives

The No-Project Alternative would not meet many of the project objectives listed in Chapter 2 (and reiterated above). The No-Project Alternative fails to provide maximum technologically feasible and cost-effective reductions in GHG emissions, in furtherance of achieving and maintaining the 1990 statewide GHG emissions limit (Objective 7) and continuing reductions beyond 2020 (Objective 2).

The No-Project Alternative is not consistent with Project Objectives 8, 9, 10 and 13, which address achieving additional air quality and health co-benefits. As discussed in the Proposed Update, there is a need to reduce short-lived climate pollutants such as black carbon and methane. The recommended actions in the Proposed Update would contribute substantially to achieving the stated objective of preventing increases in other pollutant emissions, including criteria air pollutants (CAPs) or toxic air contaminants (TACs). Therefore, the No-Project Alternative is not consistent with this objective to achieve and maximize CAP and TAC emission reduction co-benefits.

Furthermore, the No-Project Alternative is not consistent with Project Objectives 1 and 2, which addresses the need to update the plan to achieve the maximum technologically feasible and cost-effective GHG reductions and to maintain and continue reductions in GHG emissions beyond 2020. The stated objective of the Plan Update is setting California on track to meet its longer-term climate goal of achieving climate stabilization necessary to protect the existing environment of California. As indicated in the Proposed Update, Executive Order S-3-05 and Governor Brown's Executive Order (EO) B-16-2012 establish long-term climate goals for California to reduce GHG emissions to 80 percent below 1990 levels by 2050 (EO B-16-2012 is specific to the transportation sector). These 2050 goals are consistent with an Intergovernmental Panel on Climate Change (IPCC) analysis of the emissions trajectory that would stabilize atmospheric GHG concentrations at 450 parts per million carbon dioxide equivalent (CO_2e) and reduce the likelihood of catastrophic climate change. Progressing toward California's long-term climate goals will require that GHG emission reduction rates be significantly accelerated through a continuation of existing policies and implementation of new ones to encourage market adoption of the cleanest, most efficient technologies. (See Chapter II of the Proposed Update, "Latest Understanding of Climate Science.")

ii) Environmental Impacts

The No-Project Alternative includes GHG emission reduction measures that are ongoing or already implemented as part of the initial Scoping Plan, or developed under authorities additional to AB 32. Direct and indirect environmental impacts associated with implementation of these measures were analyzed in the 2008 Functional Equivalent Document (FED) and 2011 FED Supplement, and are incorporated by reference and summarized in Attachment 3 of this EA. The No-Project Alternative, therefore, would still result in potential adverse environmental impacts as summarized in the tables in Attachment 3.

The No-Project Alternative would, however, avoid the additional potential environmental impacts associated with the recommended actions in the Proposed Update identified in Chapter 4 of this document. These include potential impacts resulting from short-term construction and long-term operational impacts that may occur as a result of activities carried out in response to regulations or programs enacted to implement the recommended actions. The resource areas affected include aesthetics, agricultural resources, air quality, biological resources, cultural resources, geology and soils, hazardous materials, hydrology and water quality, noise, transportation/traffic, and utilities and service systems, as described in Chapter 4 and summarized in the table in Attachment 1.

2. Alternative 2: Reduced-Intensity Project Alternative

a) Alternative 2 Description

Under Alternative 2, the Reduced-Intensity Alternative, only some of the recommended actions in the economic sectors of the Proposed Update would be approved, based on the goal of reducing or avoiding potentially significant impacts.

As described in Chapter 4 and shown in the impact summary table in Attachment 1, recommended actions in most of the nine economic sectors in the Proposed Update would result in a number of potentially significant and unavoidable impacts after mitigation. The impact analysis in Chapter 4 does not focus on impacts for individual actions recommended in each sector, but rather for a set of reasonably foreseeable compliance responses to the range of recommended actions identified in each sector. Furthermore, there is considerable variation in each sector of the Proposed Update in terms of potentially significant and unavoidable impacts in each resource, compared to beneficial or less-than-significant impacts. Thus, Alternative 2 could be defined in a number of different ways, as discussed below.

- Only one of the sectors in the Proposed Update (Agriculture) would result in less-than-significant or beneficial impacts in all resource areas. For the remaining eight sectors, potentially significant and unavoidable impacts defined for many of the resource areas, with variability in terms of which resource areas the impacts would occur. Alternative 2 could thus limit the proposed project to implementing only the recommended actions in the Agriculture Sector, which would strictly avoid all potentially significant and unavoidable impacts in the Proposed Update. This would result in a much smaller set of recommended actions in one economic sector, compared to implementing the full set of actions in the nine sectors contained in the Proposed Update.
- For a few specific environmental resource areas, such as air quality, recommended actions in some of the sectors would result in beneficial or less-than-significant long-term operational impacts, while recommended actions in other sectors would result in potentially significant and unavoidable long-term operational air quality impacts. The sectors in which recommended actions would result in beneficial or less-than-significant, long-term

operational air quality impacts include Energy, Agriculture, Water, Short-Lived Climate Pollutants, and Green Buildings. Alternative 2 could thus limit the proposed project to implementing only the recommended actions in these six sectors to avoid long-term operational air quality impacts.

- Similar to the previous air quality scenario, a reduced-intensity scenario for Alternative 2 could be developed for other environmental resource topics where the potential impacts associated with recommended actions in each sector may vary, such as long-term operational impacts on Utilities and Service Systems, in which case only Energy and Agriculture would avoid potentially significant impacts.

b) Alternative 2 Impact Discussion

i) Objectives

The reduced number of recommended actions under any of the scenarios described above under Alternative 2 would provide fewer GHG emission reductions in furtherance of achieving and maintaining the statewide 2020 GHG emissions limit and continuing reductions in emissions of GHG emissions beyond 2020. Therefore, this alternative is considerably less effective at meeting objectives 1, 2, 3 and 7.

Alternative 2 would be consistent with the remaining project objectives, but would achieve the outcomes desired under those objectives to a lesser extent, and potentially much lesser extent, depending on the scenario, than the Proposed Update. Many of the recommended actions included in the Proposed Update also contribute to achieving the stated objective of preventing increases in other pollutant emissions, such as CAPs or TACs, including black carbon and methane which are short-lived climate pollutants, consistent with Project Objectives 8, 9, 10 and 13. Alternative 2 would not achieve CAP and TAC emission reduction co-benefits in any of the scenarios in which recommended action in certain sectors would be excluded, such as in the Transportation Sector.

Therefore, while Alternative 2 meets some of the basic project objectives, it would likely achieve substantially fewer GHG emission reductions and overall is less effective at achieving the project objectives compared to the Proposed Update.

ii) Environmental Impacts

As described above, Alternative 2 could eliminate a range of recommended actions identified in the Proposed Update for which potentially significant and unavoidable impacts were identified in Chapter 4, depending on which reduced-intensity scenario would be selected.

The only scenario in which all potentially significant and unavoidable impacts would be avoided is if ARB adopted and implemented the Proposed Update with recommended actions only in the Agriculture Sector. Under that scenario, all potentially significant construction-related and long-term operation impacts to aesthetics, agriculture and forest resources, air quality, biological resources, cultural resources, geology and soils,

hazardous materials, hydrology and water quality, noise, transportation/traffic, and utilities and service systems, would be avoided.

Under the other scenarios described above, only the potentially significant impacts in certain resource areas would be avoided (e.g., air quality or utilities and service systems), based on approving recommended actions in specific sectors. For other resource areas, the potentially significant and unavoidable environmental effects would remain.

3. Alternative 3: Extend the Cap-and-Trade Regulation to All Economic Sectors Alternative

a) Alternative 3 Description

Under Alternative 3, Extend the Cap-and-Trade Regulation to All Economic Sectors, ARB would broaden the reach of the State's market-based Cap-and-Trade Regulation to include regulation of a full range of economic sectors under the emissions cap, rather than the focused application to specific covered entities that is the basis for the existing program. Any GHG emission reductions that would have otherwise occurred through implementation of specific actions or regulations in the "uncapped sectors" under the Proposed Update post-2020 would become covered under the declining emissions cap, along with those currently in the capped sectors. The current "uncapped sectors" includes the following economic sectors (or specific sources within economic sectors): Agriculture, Forests, High-GWP F-gases, Oil and Gas Extraction and Transmission, and Recycling and Waste.

The Proposed Update builds upon the initial Scoping Plan strategy of implementing a broad set of recommended actions to reduce GHG emissions across economic sectors, along with a statewide Cap-and-Trade Regulation that applies a firm and declining emission reduction cap on a focused set of covered entities that represent approximately 85 percent of total statewide GHG emissions. The Proposed Update also includes a recommendation to continue the Cap-and-Trade Regulation beyond 2020, but does not broaden its reach to additional sectors. Thus, the essential difference between the Proposed Update and Alternative 3 is that the Cap-and-Trade Regulation would be implemented across all economic sectors, and not just the limited covered entities under the current program. ARB or other lead agencies could still pursue any of the recommended actions under the Proposed Update, in addition to implementing the broader Cap-and-Trade Regulation under this Alternative, because changes to the Cap-and-Trade Regulation would not replace the recommended actions.

Similar to the existing Cap-and-Trade Regulation, under Alternative 3 the number of allowances issued per year would be steadily reduced under the declining emissions cap on all sectors to meet the State's 2050 emission goals. Some smaller sources of GHG emissions, such as high-global warming potential (GWP) fluorinated gases (F-gases), could be regulated upstream at the distribution level. However, other smaller emission sources, such as methane emitters, would be regulated on a source-by-source basis.

Reasonably foreseeable compliance responses would be similar to those under the current Cap-and-Trade Regulation and addressed in the FED prepared for the Cap-and-Trade Regulation in 2010. This would likely include continued implementation of projects under currently adopted compliance offset protocols (i.e., U.S. Forest Projects, Urban Forest Projects, Livestock Projects, and Ozone-Depleting Substance [ODS] Compliance), as well as the development of additional compliance offset protocols and associated offset projects consistent with the goals and procedures of the existing Cap-and-Trade Regulation. However, because the program would be extended to all economic sectors in the State, the supply of available offsets in the currently-uncapped sectors would be virtually eliminated, as the only projects eligible for offsets would be in sectors not regulated or capped in the State.

b) Alternative 3 Impact Discussion

i) Objectives

Extending the Cap-and-Trade Regulation to all economic sectors under this alternative would be consistent with a number of the project objectives. The State would still pursue GHG emission reductions through this program in all economic sectors to maintain and continue reductions beyond 2020 (Objectives 2 and 3). Reductions in fossil fuel use, diversification of energy sources and maintaining electric system reliability would likely continue (Objective 4).

Extending the Cap-and-Trade Regulation to the currently uncapped sectors would require ongoing enforcement, monitoring and verification by ARB. This could prove difficult as both the technical methodology and resources required to ensure that GHG emission reductions in these sectors are real, permanent, quantifiable, verifiable and enforceable, are not yet well-defined. Therefore, this alternative could fail to meet Objectives 5 and 6. For related reasons, this alternative could fail to meet Objective 11 due to potential increases in administrative burden for both implementation and compliance with the Regulation.

Objectives 7 through 9 could potentially be achieved by this alternative, as the Cap-and-Trade Program would continue to allow covered entities to achieve maximum technologically feasible and cost-effective reductions in GHG emissions, avoid disproportionate impacts, and complement existing air standards.

A number of public benefits and co-benefits could still be achieved by a broadened Cap-and-Trade Regulation consistent with Objectives 10 and 13; however, the opportunity to align and implement specific recommended actions in the Proposed Update that would support or complement other statewide initiatives and maximize a broad range of benefits to the economy, environment, and public health would be diminished.

ii) Environmental Impacts

Reasonably foreseeable compliance responses under this alternative would likely be similar to those under the current Cap-and-Trade Regulation, and, therefore, any potentially significant impacts analyzed in the 2010 Cap-and-Trade FED would likely be

similar under Alternative 3. Potentially significant impacts would also be similar to those disclosed in this EA for the recommended actions in the Proposed Update, because GHG emission reductions would still occur as a result of implementing some or all of the recommended actions in all sectors, along with similar or additional compliance responses under a broadened Cap-and-Trade Regulation under this alternative.

It is not expected that any of the potentially significant and unavoidable impacts identified in this EA for the Proposed Update would be reduced or avoided by Alternative 3, because of the similarity in the scope and types of reasonably foreseeable compliance responses between the Proposed Update and this alternative.

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ATTACHMENT 1: SUMMARY OF IMPACTS BY SECTOR

Attachment 1: Summary of Impacts by Sector									
	Energy Sector	Transportation Sector	Agriculture Sector	Water Sector	Waste Management Sector	Natural and Working Lands Sector	Short-Lived Climate Pollutants Sector	Green Buildings	Cap-and-Trade Regulation
Aesthetics									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Agriculture and Forest Resources									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	SU	B	SU	SU	SU	SU	SU	See Attachment 3
Air Quality									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	LTS	SU	B	LTS	LTS/SU*	SU	LTS	B	See Attachment 3
Biological Resources									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	SU	B	SU	SU	LTS	SU	SU	See Attachment 3
Cultural Resources									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	NA	NA	NA	NA	NA	NA	NA	NA	See Attachment 3
Energy Demand									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	B	B	B	LTS	B	B	LTS	B	See Attachment 3

Attachment 1: Summary of Impacts by Sector									
	Energy Sector	Transportation Sector	Agriculture Sector	Water Sector	Waste Management Sector	Natural and Working Lands Sector	Short-Lived Climate Pollutants Sector	Green Buildings	Cap-and-Trade Regulation
Geology and Soils									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Greenhouse Gas									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	B	B	B	B	B	LTS	B	B	See Attachment 3
Hazards and Hazardous Materials									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Hydrology and Water Quality									
Short-Term Construction Impacts	SU	SU	B	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	SU	B	SU	SU	B	SU	SU	See Attachment 3
Land Use Planning									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3

Attachment 1: Summary of Impacts by Sector									
	Energy Sector	Transportation Sector	Agriculture Sector	Water Sector	Waste Management Sector	Natural and Working Lands Sector	Short-Lived Climate Pollutants Sector	Green Buildings	Cap-and-Trade Regulation
Mineral Resources									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Noise									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	SU	LTS	LTS	LTS	LTS	SU	LTS	SU	See Attachment 3
Population and Housing									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Public Services									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Recreation									
Short-Term Construction Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3
Transportation/Traffic									
Short-Term Construction Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3
Long-Term Operational Impacts	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	See Attachment 3

Attachment 1: Summary of Impacts by Sector									
	Energy Sector	**Transportation Sector**	**Agriculture Sector**	**Water Sector**	**Waste Management Sector**	**Natural and Working Lands Sector**	**Short-Lived Climate Pollutants Sector**	**Green Buildings**	**Cap-and-Trade Regulation**
Utilities and Service Systems									
Short-Term Construction Impacts	NA	NA	NA	NA	NA	NA	NA	NA	See Attachment 3
Long-Term Operational Impacts	SU	SU	LTS	SU	SU	SU	SU	SU	See Attachment 3

Notes: B = Beneficial; LTS = Less Than Significant; NA = Not Applicable; SU = Potentially Significant and Unavoidable After Mitigation.
*Long-term operational impacts were identified as LTS, but odor-related impacts were identified as significant and unavoidable in the Waste Management sector.

ATTACHMENT 2: ENVIRONMENTAL AND REGULATORY SETTING

1.0 AESTHETICS

A. Existing Conditions

California, by virtue of its size, setting, and topographic and climate variation, exhibits tremendous scenic diversity. The varied landscape ranges from coastal to desert and valley to mountain. Innumerable natural features and settings combine to produce scenic resources that are treasured by residents and visitors alike.

Aesthetic value can be affected by visibility, which is directly related to the presence of airborne particles. Visibility-reducing particles consist of suspended particulate matter, a complex mixture of tiny particles consisting of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. Particles vary greatly in shape, size, and chemical composition, and can be made up of many different materials such as metals, soot, soil, dust, and salt (ARB 2009).

B. Regulatory Setting

Applicable laws and regulations associated with aesthetics and scenic resources are discussed in Table 1.

Table 1: Applicable Laws and Regulations for Aesthetic Resources

Applicable Regulations	Description
Federal	
Federal Land Policy and Management Act of 1976 (FLPMA)	FLPMA is the enabling legislation establishing the Bureau of Land Management's responsibilities for lands under its jurisdiction. Section 102 (a) of the FLPMA states that "…the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resources, and archeological values…" Section 103(c) identifies "scenic values" as one of the resources for which public land should be managed.
Bureau of Land Management (BLM) Contrast Rating System	The contrast rating system is a systematic process used by BLM to analyze visual impacts of proposed projects and activities. It is primarily intended to assist BLM personnel in the resolution of visual impact assessment.
Moving Ahead for Progress in the 21st Century (MAP-21)	The MAP-21 was signed into law in July 2012. It effectively supersedes the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
Natural Historic Preservation Act (NHPA)	Under regulations of the NHPA, visual impacts to a listed or eligible National Register property that may diminish the integrity of the property's "setting … [or] … feeling" in a way that affects the property's eligibility for listing may result in a potentially significant adverse effect. "Examples of adverse

Table 1: Applicable Laws and Regulations for Aesthetic Resources	
Applicable Regulations	**Description**
	effects … include…: Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features." (36 CFR Part 800.5)
National Scenic Byways Program	Title 23, Sec 162 outlines the National Scenic Byways Program. This program is used to recognize roads having outstanding scenic, historic, cultural, natural, recreational, and archaeological qualities through designation of road as: National Scenic Byways; All-American Roads; or America's Byways. Designation of the byways provides eligibility for Federal assistance for safety improvement, corridor management plans, recreation access, or other project that protect scenic, historical, recreational, cultural, natural, and archaeological resources.
State	
Ambient Air Quality Standard for Visibility-Reducing Particles	Extinction coefficient (measure of absorption of light in a medium) of 0.23 per kilometer — visibility of ten miles or more (0.07 — 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent.
California Streets and Highway Code, Section 260 through 263 – Scenic Highways	The State Scenic Highway Program promotes protection of designated State scenic highways through certification and adoption of local scenic corridor protection programs that conform to requirements of the California Scenic Highway Program.
Local	
County and City Controls	Most local planning guidelines to preserve and enhance the visual quality and aesthetic resources of urban and natural areas are established in the jurisdiction's General Plan. The value attributed to a visual resource generally is based on the characteristics and distinctiveness of the resource and the number of persons who view it. Vistas of undisturbed natural areas, unique or unusual features forming an important or dominant portion of a viewshed, and distant vistas offering relief from less attractive nearby features are frequently considered to be scenic resources. In some instances, a case-by-case determination of scenic value may be needed, but often there is agreement within the relevant community about which features are valued as scenic resources. In addition to federal and State designations, counties and cities have their own scenic highway designations, which are intended to preserve and enhance existing scenic resources. Criteria for designation are commonly included in the conservation/open space element of the city or County General Plan.

C. Agricultural and Forest Resources

1. Existing Conditions

The California Department of Conservation's (DOC's) FMMP inventories agricultural resources based on soil quality and land use within California. FMMP uses the following definitions to describe farmland types.

- Prime Farmland is defined by the DOC as "Land with the best combination of physical and chemical features able to sustain long term production of agricultural crops. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for production of irrigated crops at some time during the past four years."
- Farmland of Statewide Importance is defined by the DOC as "Land similar to Prime Farmland that has a good combination of physical and chemical characteristics for the production of agricultural crops. This land has minor shortcomings, such as greater slopes or less ability to store soil moisture than Prime Farmland. Land must have been used for production of irrigated crops at some time during the past four years."
- Unique Farmland is defined by the DOC as "Lesser quality soils used for the production of the State's leading agricultural crops. This land is usually irrigated, but may include non-irrigated orchards or vineyard as found in some climatic zones in California."

As of 2008, of California's approximately 100 million acre of land, 31.6 million acres are used for agriculture. Of this, 19.2 million acres are grazing land and 12.4 million acres are cropland. Farmland considered to be prime, unique or of statewide importance covers 12 million acres (DOC 2008). California has been the top agricultural producer of all states in the U.S. for approximately 50 years. The DOC determined that farm and grazing land decreased by more than 1.3 million acres between 1984 and 2008. Conversion to urban land contributes more than 1.04 million acres over this time period.

Of the 85 million acres of wildlands in California, nearly 17 million are commercial forest land, half privately-owned and half government-owned. Forest land grows 3.8 billion board feet annually. Approximately 2 billion board feet of timber is harvested per year. State wild lands also provide valuable watershed, wildlife habitat, and recreation resources.

2. Regulatory Setting

Table 2 below provides a general description of applicable laws and regulations that may pertain to agriculture and forest resources associated with the Air Resources Board (ARB) 2013 Scoping Plan Update

Table 2: Applicable Laws and Regulations for Agriculture and Forest Resources	
Applicable Regulations	**Description**
Federal	
Farmland Protection Policy Act (FPPA)	FPPA directs federal agencies to consider the effects of federal programs or activities on farmland, and ensure that such programs, to the extent practicable, are compatible with state, local and private farmland protection programs and policies. The rating process established under the FPPA was developed to help assess options for land use on an evaluation of productivity weighed against commitment to urban development.
National Forest Management Act (NFMA) of 1976	NFMA is the primary statute governing the administration of national forests. The act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. Goal 4 of the U.S. Forest Service's National Strategic Plan for the National Forests states that the nation's forests and grasslands play a significant role in meeting America's need for producing and transmitting energy. Unless otherwise restricted, National Forest Service lands are available for energy exploration, development, and infrastructure (e.g., well sites, pipelines, and transmission lines). However, the emphasis on non-recreational special uses, such as utility corridors, is to authorize the special uses only when they cannot be reasonably accommodated on non-National Forest Service lands.
State	
The California Land Conservation Act, also known as the Williamson Act (Government Code Section 51200)	The DOC's Division of Land Resource Protection administers the Williamson Act program, which permits property tax adjustments for landowners who contract with a city or county to keep their land in agricultural production or approved open space uses for at least 10 years. Lands covered by Williamson Act contracts are assessed on the basis of their agricultural value instead of their potential market value under nonagricultural uses. In return for the preferential tax rate, the landowner is required to contractually agree to not develop the land for a period of at least 10 years. Williamson Act contracts are renewed annually for 10 years unless a party to the contract files for nonrenewal. The filing of a non-renewal application by a landowner ends the automatic annual extension of a contract and starts a 9-year phase-out of the contract. During the phase-out period, the land remains restricted to agricultural and open-space uses, but property

Table 2: Applicable Laws and Regulations for Agriculture and Forest Resources	
Applicable Regulations	**Description**
	taxes gradually return to levels associated with the market value of the land. At the end of the 9-year non-renewal process, the contract expires and the owner's uses of the land are restricted only by applicable local zoning. The Williamson Act defines compatible use of contracted lands as any use determined by the county or city administering the agricultural preserve to be compatible with the agricultural, recreational, or open space use of land within the preserve and subject to contract (Government Code, Section 51202[e]). However, uses deemed compatible by a county or city government must be consistent with the principles of compatibility set forth in Government Code, Section 51238.1. Approximately 16 million acres of farmland (about 50 percent of the State's total farmland) are enrolled in the program.
California Farmland Conservancy Program (CFCP) (Public Resources Code [PRC] Section 10200)	The program provides grant funding for agricultural conservation easements. Although the easements are always written to reflect the benefits of multiple resource values, there is a provision in the CFCP statute that prevents easements funded under the program from restricting husbandry practices. This provision could prevent restricting those practices to benefit other natural resources.
Farmland Mapping and Monitoring Program (FMMP) (Government Code Section 65570, PRC Section 612)	Under the FMMP, the California DOC assesses the location, quality, and quantity of agricultural lands and conversion of these lands over time. Agricultural designations include the categories of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, Grazing Land, Urban and Built-Up Land, and Other Land.
State Lands Commission Significant Land Inventory	The State Lands Commission is responsible for managing lands owned by the State, including lands that the State has received from the federal government. These lands total more than four million acres and include tide and submerged lands, swamp and overflow lands, the beds of navigable waterways, and State School Lands. The State Lands Commission has a legal responsibility for, and a strong interest in, protecting the ecological and Public Trust values associated with the State's sovereign lands, including the use of these lands for habitat preservation, open space and recreation. Scoping Plan projects located within these lands would be subject to the State Lands Commission permitting process.

Table 2: Applicable Laws and Regulations for Agriculture and Forest Resources	
Applicable Regulations	**Description**
Local	
Open Space Element	State law requires each city and county to adopt a general plan containing at least seven mandatory elements including an open space element. The open space element identifies open space resources in the community and strategies for protection and preservation of these resources. Agricultural and forested lands are among the land use types identified as open space in general plans.

2.0 AIR QUALITY

A. Existing Conditions

Federal, State, and local governments all share responsibility for reducing air pollution. ARB is California's lead air agency and controls emissions from mobile sources, fuels, and consumer products, as well as air toxics. ARB also coordinates local and regional emission reduction measures and plans that meet federal and State air quality limits. At the federal level, the US EPA has oversight of State programs. In addition, US EPA alone establishes emission standards for certain mobile sources such as ships, trains, and airplanes.

1. Criteria Air Pollutants

Concentrations of emissions of criteria air pollutants (CAPs) are used to indicate the quality of the ambient air because these are the most prevalent air pollutants known to be deleterious to human health. A brief description of each CAP is provided below. Emission source types and health effects are summarized in Table 3.

Table 3: Sources and Health Effects of Criteria Air Pollutants			
Pollutant	**Sources**	**Acute[1] Health Effects**	**Chronic[2] Health Effects**
Ozone	Secondary pollutant resulting from reaction of reactive organic gases (ROG) and oxides of nitrogen (NO_X) in presence of sunlight. ROG emissions result from incomplete combustion and evaporation of chemical solvents and fuels; NO_X results from the	Increased respiration and pulmonary resistance; cough, pain, shortness of breath, lung inflammation	Permeability of respiratory epithelia, possibility of permanent lung impairment

Table 3: Sources and Health Effects of Criteria Air Pollutants			
Pollutant	**Sources**	**Acute[1] Health Effects**	**Chronic[2] Health Effects**
	combustion of fuels		
Carbon monoxide (CO)	Incomplete combustion of fuels; motor vehicle exhaust	Headache, dizziness, fatigue, nausea, vomiting, death	Permanent heart and brain damage
Nitrogen dioxide (NO_2)	Combustion devices; e.g., boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines	Coughing, difficulty breathing, vomiting, headache, eye irritation, chemical pneumonitis or pulmonary edema; breathing abnormalities, cough, cyanosis, chest pain, rapid heartbeat, death	Chronic bronchitis, decreased lung function
Sulfur dioxide (SO_2)	Coal and oil combustion, steel mills, refineries, and pulp and paper mills	Irritation of upper respiratory tract, increased asthma symptoms	Insufficient evidence linking SO_2 exposure to chronic health impacts
Respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$)	Fugitive dust, soot, smoke, mobile and stationary sources, construction, fires and natural windblown dust, and formation in The atmosphere by condensation and/or transformation of SO_2 and ROG	Breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular diseases, premature Death	Alterations to the immune system, carcinogenesis
Lead	Metal processing	Reproductive/ developmental effects (fetuses and children)	Numerous effects including neurological, endocrine, and cardiovascular effects

[1] Acute" refers to effects of short-term exposures to criteria air pollutants, usually at relatively high concentrations.
[2] Chronic" refers to effects of long-term exposures to criteria air pollutants, even at relatively low concentrations.
Sources: EPA 2011a.

2. Ozone

Ozone is a photochemical oxidant (a substance whose oxygen combines chemically with another substance in the presence of sunlight) and the primary component of smog. Ozone is not directly emitted into the air but is formed through complex chemical reactions between precursor emissions of reactive organic gases (ROG) and oxides of nitrogen (NO_X) in the presence of sunlight. ROG are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. NO_X are a group of gaseous compounds of nitrogen and oxygen that result from the combustion of fuels.

Emissions of the ozone precursors ROG and NO_X have decreased over the past several years because of more stringent motor vehicle standards and cleaner burning fuels. During the last 20 years the maximum amount of ROG and NO_X over an 8-hour period decreased by 17 percent. However, most counties in California are in nonattainment for ozone.

3. Nitrogen Dioxide

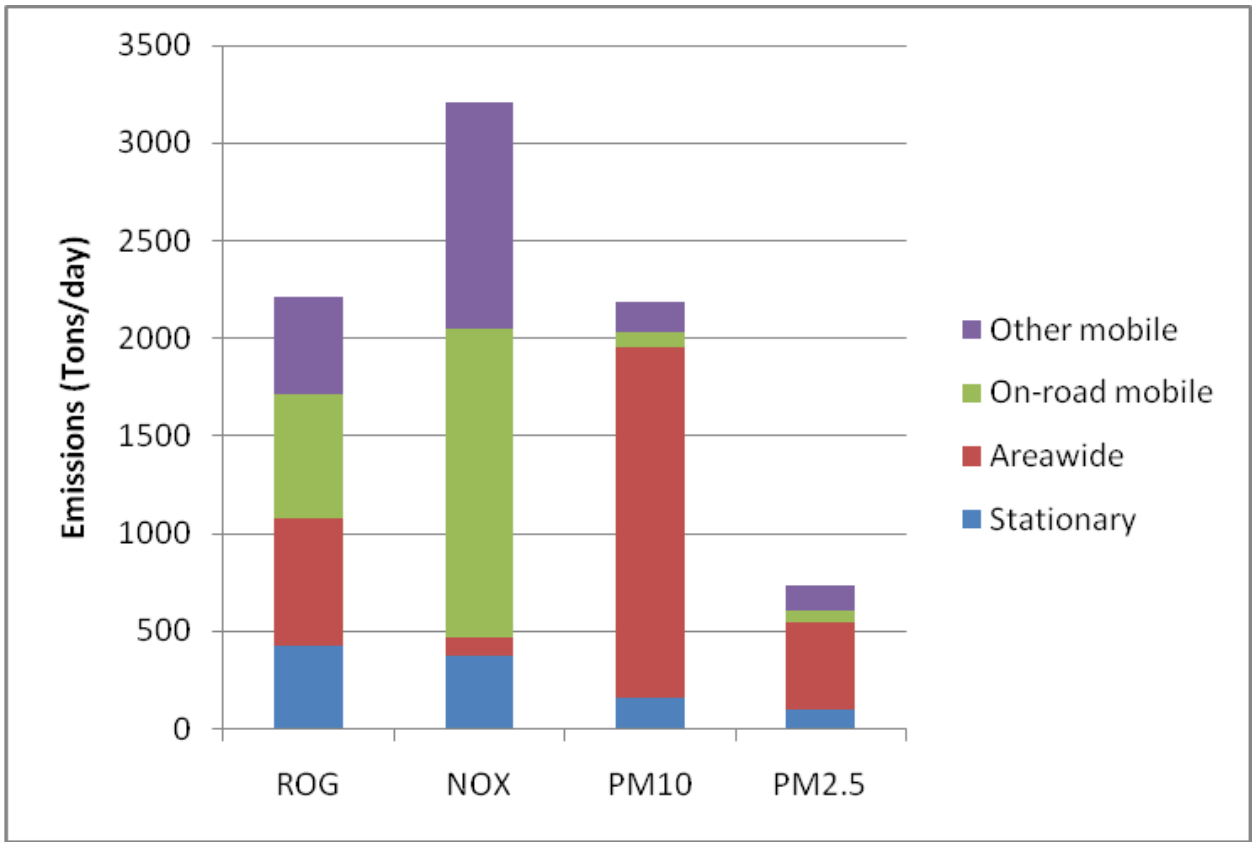
NO_2 is a brownish, highly-reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices, such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Combustion devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2. The combined emissions of NO and NO_2 are referred to as NO_X and are reported as equivalent NO_2. Because NO_2 is formed and depleted by reactions associated with photochemical smog (ozone), the NO_2 concentration in a particular geographical area may not be representative of the local sources of NO_X emissions (EPA 2011a).

4. Particulate Matter

Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction equipment, fires and natural windblown dust, and particulate matter formed in the atmosphere by reaction of gaseous precursors (ARB 2009). $PM_{2.5}$ includes a subgroup of smaller particles that have an aerodynamic diameter of 2.5 micrometers or less. PM_{10} emissions in California are dominated by emissions from area sources, primarily fugitive dust from vehicle travel on unpaved and paved roads, farming operations, construction and demolition, and particles from residential fuel combustion. Direct emissions of PM_{10} have increased slightly in California over the last 20 years, and are projected to continue. $PM_{2.5}$ emissions have remained relatively steady over the last 20 years and are projected to increase slightly through 2020. Emissions of $PM_{2.5}$ are dominated by the same sources as emissions of PM_{10} (ARB 2009).

5. Emissions Inventory

Exhibit 1 summarizes emissions of CAPs within California for various source categories. According to California's emissions inventory, mobile sources are the largest contributor to the estimated annual average for air pollutant levels of ROG and NO_X accounting for approximately 51 percent and 86 percent respectively, of the total emissions. Area wide sources account for approximately 89 percent and 73 percent of California's PM_{10} and $PM_{2.5}$ emissions, respectively (ARB 2008).



Source: ARB 2008
Exhibit 1 California 2008 Emissions Inventory

6. Toxic Air Contaminants

Concentrations of toxic air contaminants (TACs) are also used to indicate the quality of ambient air. A TAC is defined as an air pollutant that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

According to the *California Almanac of Emissions and Air Quality* (ARB 2009), the majority of the estimated health risks from TACs can be attributed to relatively few compounds, the most predominant being particulate-exhaust emissions from diesel-fueled engines (diesel PM). Diesel PM differs from other TACs in that it is not a single

substance, but rather a complex mixture of hundreds of substances. Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emissions control system is being used. Unlike some TACs, no ambient monitoring data are available for diesel PM because no routine measurement method currently exists. However, ARB has made preliminary concentration estimates based on a PM exposure method. This method uses the ARB emissions inventory's PM_{10} database, ambient PM_{10} monitoring data, and the results from several studies to estimate concentrations of diesel PM. In addition to diesel PM, the TACs for which data are available that pose the greatest existing ambient risk in California are benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, paradichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene.

Diesel PM poses the greatest health risk among these 10 TACs mentioned. Since 1990, the health risk associated with diesel PM has been in California has reduced by 52 percent. Overall, levels of most TACs, except paradichlorobenzene and formaldehyde, have decreased since 1990 (ARB 2009: Chapter 5).

B. Regulatory Setting

Table 4: Applicable Laws and Regulations for Air Quality

Regulation	Description
Federal	
Clean Air Act (CAA) (40 CFR)	CAA, which was last amended in 1990, requires the United States Environmental Protection Agency (US EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of NAAQS. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. US EPA Office of Air Quality Planning and Standards (OAQPS) has set NAAQS for six principal pollutants, which are called "criteria" pollutants. Title III of the CAA directed the US EPA to promulgate national emissions standards for Hazardous Air Pollutants (NESHAP). The CAA also required the US EPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions, at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to

Table 4: Applicable Laws and Regulations for Air Quality	
Regulation	**Description**
	further reduce mobile-source emissions.
SmartWay	SmartWay is a US EPA program that reduces transportation-related emissions by creating incentives to improve supply chain fuel efficiency. It aims to increase the availability and market penetration of fuel efficient technologies and strategies that help freight companies save money while also reducing adverse environmental impacts.
Other Applicable Federal-Level Regulations	This includes all other applicable regulations at the federal level for portions of the project area that are outside of the U.S. (e.g., Canada).
State	
California Clean Air Act (CCAA) CCR (Titles 13 and 17)	ARB is the agency responsible for coordination and oversight of State and local air pollution control programs in California and for implementing the CCAA. The CCAA, which was adopted in 1988, required the ARB to establish California ambient air quality standards (CAAQS).
Waste Heat and Carbon Emissions Reduction Act	This Act is designed to encourage the development of new combined heat and power (CHP) systems in California with a generating capacity of not more than 20 megawatts. Section 2843 of the Act provides that the Energy Commission's guidelines require that CHP systems: be designed to reduce waste energy; have a minimum efficiency of 60 percent; have NO_X emissions of no more than 0.07 pounds per megawatt-hour; be sized to meet the eligible customer generation thermal load; operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat; be cost effective, technologically feasible, and environmentally beneficial.
Other Applicable State-Level Regulations	This includes all other applicable regulations at the State level for portions of the project area that are outside of California (e.g., AB 1807and AB 2588).

3.0 BIOLOGICAL RESOURCES

A. Existing Conditions

California's diverse topography and climate have given rise to a remarkable diversity of habitats and a correspondingly diverse array of both plant and animal species. California has more species than any other state in the United States and also has the greatest number of endemic species (i.e., species that occur only in the State)

Geographic and climatic forces have shaped the State's topography and soils. Glaciation, sedimentary and volcanic deposits, movement along fault zones, the uplift of

subterranean rock and sediment layers, and gradual erosion have created unique topographical features and a mosaic of bedrock and soil types.

The state's geography and topography have created distinct local climates. North to south, the state extends for over 500 miles, bridging the temperate rainforests in the Pacific Northwest and the subtropical arid deserts of Mexico. Many parts of the state experience Mediterranean weather patterns, with cool, wet winters and hot, dry summers. Along the northern coast there is abundant precipitation, and ocean air produces foggy, moist conditions. High mountains have cool conditions, with a deep winter snow pack. Desert conditions exist in the rain shadow of the mountain ranges.

The exceptional variation in landscape features, latitudinal range, geological substrates and soils, and climatic conditions supports alpine meadows, desert scrub, coastal wetlands, sandy beaches, dunes and bluffs, oak woodlands, diverse grasslands, moist redwood forests, spring-fed lakes, and freshwater streams, rivers, and marshes.

1. Plant Diversity

California leads the nation in numbers of native and endemic plant species. Its 5,047 native plant species represent 32 percent of all vascular plants in the United States. Nearly one-third of the State's plant species are endemic, and California has been recognized as one of 34 global hotspots for plant diversity.

The state's native flora includes many unusual species. The giant sequoia, an ancient species that has survived from the Tertiary Age, is one of the most massive living organisms known. Coastal redwoods are the tallest trees in the world, reaching as high as 321 feet, taller than a 30-story building. A bristlecone pine in California's White Mountains, called Methuselah, at 4,767 years of age, has lived 1,000 years longer than any other known tree. California is home to the smallest flowering plant in existence, the pond-dwelling water-meal, less than one-tenth of an inch across. The state also supports nine species of carnivorous plants, including sundews, butterworts, and the California pitcher plant. Numerous species have adapted to grow on serpentine soils that are low in calcium, high in magnesium, and full of chromium, nickel, and other metals toxic to other plant species. Closed-cone conifer species, such as pygmy cypress and some chaparral plants, need hot fires to complete their life cycles.

California contains examples of most of the major biological provinces, or biomes, in North America, including grassland, shrubland, deciduous forest, coniferous forest, tundra (alpine), mountains, deserts, rainforest (temperate), marine, estuarine, and freshwater habitats. Each of these biomes contains many different types of plant communities, such as redwood forests, vernal pool wetlands, or blue oak woodlands. Altogether, the state supports 81 types of forests, 107 types of shrublands, and 52 types dominated by herbaceous plants, in addition to 27 other types of vegetation. Some of California's plant species and communities, such as mixed conifer forests, chamise chaparral, and creosote scrub, are widespread. Others are highly restricted in their

distributions, such as unique stands of Crucifixion-thorn, Gowen cypress, Hinds walnut, and Torrey pine.

Some parts of the state are particularly rich in plant species diversity. Areas with the greatest number of plant species are the Klamath and inner North Coast ranges, the high Sierra Nevada, the San Diego region, and the San Bernardino Mountains. Other regions with considerable plant diversity are the outer North and Central Coast Ranges, the Cascade Range, the Sierra Nevada foothills, and the western Transverse Range (CDFW 2007).

2. Wildlife Diversity

California's diverse natural communities provide a wide variety of habitat conditions for wildlife. The state's wildlife species include 84 species of reptiles (30 percent of the total number found in the United States); 51 species of amphibians (22 percent of U.S. species); 67 species of freshwater fish (8 percent of U.S. species); 433 species of birds (47 percent of U.S. species); and 197 mammal species (47 percent of U.S. species). Seventeen species of mammals, 17 species of amphibians, and 20 species of freshwater fish are endemic to California.

Twenty-four habitats—including valley foothill riparian, mixed conifer, freshwater wetlands, mixed chaparral, and grasslands in the state—support more than 150 terrestrial animal species each. Oak woodlands also are among the most biological diverse communities in the state, supporting 5,000 species of insects, more than 330 species of amphibians, reptiles, birds and mammals, and several thousand plant species. Other community types may be especially important to a particular species or species group. For example, California's rocky offshore islands typically support a limited number of species but are nonetheless important habitat for those species that depend on them for nesting; the islands host some of the largest breeding colonies of seabirds in the U.S. In addition, California is part of the Pacific Flyway, an avian migratory pathway that stretches along the Pacific Coast from Mexico north to Alaska and into Siberia, Russia (CDFW 2007).

B. Regulatory Setting

Table 5: Applicable Laws and Regulations for Biological Resources

Applicable Law	Description
Federal	
Federal Endangered Species Act	Designates and provides for protection of threatened and endangered plant and animal species, and their critical habitat.
Migratory Bird Treaty Act	Makes it unlawful to take or possess any migratory nongame bird (or any part of such migratory nongame bird) as designated in the Migratory Bird Treaty Act.
Clean Water Act (CWA)	Requires the permitting and monitoring of all discharges to surface water bodies. Section 404 requires a permit from the

Table 5: Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
	U.S. Army Corps of Engineers (USACE) for a discharge from dredged or fill materials into Waters of the U.S., including wetlands. Section 401 requires a permit from a regional water quality control board (RWQCB) for the discharge of pollutants. By federal law, every applicant for a federal permit or license for an activity that may result in a discharge into a California water body, including wetlands, must request State certification that the proposed activity would not violate State and federal water quality standards.
Rivers and Harbors Act of 1899	Requires permit or letter of permission from USACE prior to any work being completed within navigable waters.
US EPA Section 404 (b)(1) Guidelines	Requires the USACE to analyze alternatives in a sequential approach such that the USACE must first consider avoidance and minimization of impacts to the extent practicable to determine whether a proposed discharge can be authorized.
California Desert Conservation Area Plan (CDCA)	Comprises one of two national conservation areas established by Congress at the time of the passage of the. FLPMA outlines how BLM would manage public lands. Congress specifically provided guidance for the management of the CDCA and directed the development of the 1980 CDCA Plan.
Federal Noxious Weed Act of 1974 (P.L. 93-629) (7 U.S.C. 2801 et seq.; 88 Stat. 2148)	Establishes a federal program to control the spread of noxious weeds. Authority is given to the Secretary of Agriculture to designate plants as noxious weeds by regulation, and the movement of all such weeds in interstate or foreign commerce was prohibited except under permit.
Executive Order 13112, “Invasive Species,” February 3, 1999	Federal agencies are mandated to take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause.
Executive Order 11988, “Floodplain Management,” May 24, 1977	Requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.
Executive Order 11990, “Protection of Wetlands,” May 24, 1977	Requires all federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.
Executive Order 13186, “Responsibilities of Federal Agencies to	Requires that each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations develop and implement a

Table 5: Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
Protect Migratory Birds," January 10, 2001	Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) that shall promote the conservation of migratory bird populations.
Wild Free-Roaming Horses and Burros Act	Provides for the protection of wild free-roaming horses and burros. Directs BLM and the U.S. Forest Service (USFS) to manage wild horses and burros on lands under their jurisdiction.
Bald and Golden Eagle Protection Act	Declares it is illegal to take, possess, sell, purchase, barter, offer to sell or purchase or barter, transport, export or import a bald or golden eagle, alive or dead, or any part, nest or egg of these eagles unless authorized. Active nest sites are also protected from disturbance during the breeding season.
BLM Manual 6840 — Special Status Species Management (BLM 2001),	Establishes special status species policy on BLM land for plant and animal species and the habitats on which they depend. The policy refers species designated by the BLM State Director as sensitive.
Listed Species Recovery Plans and Ecosystem Management Strategies	Provides guidance for the conservation and management of sufficient habitat to maintain viable populations of listed species and ecosystems. Relevant examples include, but are not limited to, the Desert Tortoise Recovery Plan, Flat-tailed Horned Lizard Rangewide Management Strategy; Amargosa Vole Recovery Plan, Recovery Plan for Upland Species of the San Joaquin
State	
California Endangered Species Act of 1984 (Fish and Game Code, sections 2050 through 2098)	Protects California's rare, threatened, and endangered species.
Porter-Cologne Water Quality Control Act	Requires that each of the nine RWQCBs prepare and periodically update basin plans for water quality control. Each basin plan sets forth water quality standards for surface water and groundwater and actions to control nonpoint and point sources of pollution to achieve and maintain these standards.
Z'berg-Nejedly Forest Practice Act	Ensures that logging on timberland is performed in a manner that will preserve and protect fish, wildlife, forests and streams, enforced by the California Department for Forestry and Fire Protection (CAL FIRE).
California Forest Practice Rules 2010	State Board of Forestry and Fire Protection has authority delegated by legislature to adopt forest practice and fire protection regulations on nonfederal lands. These regulations carry out California legislature's mandates to protect and

Table 5: Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
	enhance the State's unique forest and wildland resources.
Wetlands Preservation (Keene-Nejedly California Wetlands Preservation Act) (PRC, Section 5810 et seq.)	California has established a successful program of regional, cooperative efforts to protect, acquire, restore, preserve, and manage wetlands. These programs include, but are not limited to, the Central Valley Habitat Joint Venture, the San Francisco Bay Joint Venture, the Southern California Wetlands Recovery Project, and the Inter-Mountain West Joint Venture.
California Wilderness Preservation System (PRC, Section 5093.30 et seq.)	Establishes a California wilderness preservation system that consists of State-owned areas to be administered for the use and enjoyment of the people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, provide for the protection of such areas, preserve their wilderness character, and provide for the gathering and dissemination of information regarding their use and enjoyment as wilderness.
Significant Natural Areas (Fish and Game Code section 1930 et seq.)	Designates certain areas such as refuges, natural sloughs, riparian areas, and vernal pools as significant wildlife habitat.
Protection of Birds and Nests (Fish and Game Code section 3503 and 3503.5)	Protects California's birds by making it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Raptors (e.g., hawks and owls) are specifically protected.
Migratory Birds (Fish and Game Code section 3513)	Protects California's migratory birds by making it unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame birds.
Fur-bearing Mammals (Fish and Game Code sections 4000 and 4002)	Lists fur-bearing mammals which require a permit for take.
Fully Protected Species (Fish and Game Code Sections 3511,4700, 5050, and 5515)	Identifies several amphibian, reptile, fish, bird and mammal species which are Fully Protected. The California Department of Fish and Wildlife (CDFW) cannot issue a take permit), except for take related to scientific research.
California Environmental Quality Act (CEQA Guidelines, CCR, Title 14, Section 15380)	CEQA defines rare species more broadly than the definitions for species listed under the State and federal Endangered Species Acts. Under section 15830, species not protected through State or federal listing but nonetheless demonstrable as "endangered" or "rare" under CEQA should also receive consideration in environmental analyses. Included in this category are many plants considered rare by the California Native Plant Society (CNPS) and some animals on the CDFW's Special Animals List.

Table 5: Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
Oak Woodlands (California PRC Section 21083.4)	Requires counties to determine if a project within their jurisdiction may result in conversion of oak woodlands that would have a significant adverse effect on the environment. If the lead agency determines that a project would result in a significant adverse effect on oak woodlands, mitigation measures to reduce the significant adverse effect of converting oak woodlands to other land uses are required.
Lake and Streambed Alteration Agreement (Fish and Game Code sections 1600 et seq.)	Regulates activities that may divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake in California designated by CDFW in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit. Impacts to vegetation and wildlife resulting from disturbances to waterways are also reviewed and regulated during the permitting process.
California Desert Native Plants Act of 1981 (Food and Agricultural Code section 80001 et seq. and California Fish and Game Code sections 1925-1926)	Protects non-listed California desert native plants from unlawful harvesting on both public and private lands in Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego counties. Unless issued a valid permit, wood receipt, tag, and seal by the commissioner or sheriff, harvesting, transporting, selling, or possessing specific desert plants is prohibited.
Food and Agriculture Code, Section 403	The California Department of Food and Agriculture is designated to prevent the introduction and spread of injurious insect or animal pests, plant diseases, and noxious weeds.
Noxious Weeds (Title 3, California Code of Regulations, Section 4500)	List of plant species that are considered noxious weeds.
Local	
Regional Habitat Conservation Plans (HCP) and Natural Communities Conservation Plan (NCCP)	HCPs and NCCPs establish a coordinated process for permitting and mitigating the incidental take of endangered species and conserving natural resources. Approved HCPs and NCCPs potentially relevant to proposed Advanced Clean Cars (ACC) Program include, but are not limited to, the Western Riverside County HCP; Lower Colorado River Multi-Species Conservation Plan; Coachella Valley Multi-Species HCP; Orange County Central/Coastal NCCP/HCP; Kern Water Bank HCP; Southeastern Lincoln County, Nevada HCP; and the Mojave and Colorado Desert regions and Solano Multispecies Habitat Conservation Plan.
Various City and County General Plans	General plans typically designate areas for land usages, guiding where new growth and development should occur

Table 5: Applicable Laws and Regulations for Biological Resources	
Applicable Law	**Description**
	while providing a plan for the comprehensive and long-range management, preservation, and conservation of and natural resources and open-space lands.
Various Local Ordinances	Local ordinances provide regulations for proposed projects for activities such as grading plans, erosion control, tree removal, protection of sensitive biological resources and open space.

4.0 CULTURAL RESOURCES

A. Existing Conditions

Archaeological resources include both prehistoric and historic remains of human activity. Built environment resources include an array of historic buildings, structures, and objects serving as a physical connection to California's past. Traditional or ethnographic cultural resources include Native American sacred sites (traditional cultural properties), traditional cultural places, and traditional resources of any ethnic community that are important for maintaining the cultural traditions of any group.

"Historical resources" is a term with defined statutory meaning and includes any prehistoric or historic archaeological site, district, built environment resource, or traditional cultural resource recognized as historically or culturally significant (California PRCPRC Section21084.1; 14 California Code of Regulations [CCR] Section15064.5(a)).

Paleontological resources include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains that are more than 5,000 years old and occur mainly in Pleistocene or older sedimentary rock units.

1. Cultural Resource Setting

a) Prehistoric Overview

California was occupied by different prehistoric cultures dating to at least 12,000 to 13,000 years ago. Evidence for the presence of humans during the Paleoindian Period prior to about 8,000 years ago is relatively sparse and scattered throughout the State; most surface finds of fluted Clovis or Folsom projectile points or archaeological sites left by these highly mobile hunter-gatherers are associated with Pleistocene lakeshores, the Channel Islands, or the central and southern California coast (Rondeau et al. 2007). Archaeological evidence from two of the Northern Channel Islands located off the coast from Santa Barbara indicates the islands were colonized by Paleoindian peoples at least 12,000 years ago, likely via seaworthy boats (Erlandson et al. 2007). By 10,000 years ago, inhabitants of this coastal area were using fishhooks, weaving cordage and

basketry, hunting marine mammals and sea birds, and producing ornamental shell beads for exchange with people living in the interior of the State (Erlandson et al. 2007). This is the best record of early maritime activity in the Americas, and combined with the fluted points, indicates California was colonized by both land and sea during the Paleoindian period (Jones and Klar 2007b).

With climate changes between 10,000 and 7,000 years ago at the end of the Pleistocene and into the early Holocene, Lower Archaic peoples adjusted to the drying of pluvial lakes, rise in sea level, and substantial alterations in vegetation communities. Approximately 6,000 years ago, vegetation communities similar to those of the present were established in the majority of the State, while the changes in sea level also affected the availability of estuarine resources (Jones and Klar 2007b). The archaeological record indicates subsistence patterns during the Lower Archaic and subsequent Middle Archaic Period shifted to an increased emphasis on plant resources, as evidenced by an abundance of milling implements in archaeological sites dating between 8,000 and 3,000 years ago.

Approximately 3,000 years ago, during the Upper Archaic and Late Prehistoric Periods, the complexity of the prehistoric archaeological record reflects increases in specialized adaptations to locally available resources such as acorns and salmon, in permanently occupied settlements, and in the expansion of regional populations and trade networks (Moratto 1984; Chartkoff and Chartkoff 1984; Jones and Klar 2007a). During the Upper Archaic, marine shell beads and obsidian continue to be the hallmark of long-distance trade and exchange networks developed during the preceding period (Hughes and Milliken 2007). Large shell midden/mounds at coastal and inland sites in central and southern California, for example, attest to the regular reuse of these locales over hundreds of years or more from the Upper Archaic into the Late Prehistoric period. In the San Francisco Bay region alone, over 500 shell mounds were documented in the early 1900s (Moratto 1984).

Changes in the technology used to pursue and process resources are some of the hallmarks of the Late Prehistoric period. These include an increase in the prevalence of mortars and pestles, a diversification in types of watercraft and fishhooks, and the earliest record for the bow and arrow in the State that occurs in both the Mojave Desert and northeast California nearly 2,000 years ago (Jones and Klar 2007b). The period also witnessed the beginning of ceramic manufacture in the southeast desert region, southwest Great Basin, and parts of the Central Valley.

During the Late Prehistoric period, the development of social stratification and craft specialization accompanied the increase in sedentism, as indicated by the variety of artifacts, including bone tools, coiled and twined basketry, obsidian tools, marine shell beads, personal ornaments, pipes, and rattles, by the use of clamshell disk beads and strings of dentalium shell as a form of currency, and by variation in burial types and associated grave goods (Moratto 1984; Chartkoff and Chartkoff 1984; Jones and Klar 2007a). Pictographs, painted designs that are likely less than 1,000 years old, and other non-portable rock art created during this period likely had a religious or ceremonial

function (Gilreath 2007). Osteological evidence points to intergroup conflict and warfare in some regions during this period (Jones and Klar 2007b), and there also appears to have been a decline or disruption in the long-distance trade of obsidian and shell beads approximately 1,200 years ago in parts of the State (Hughes and Milliken 2007).

b) Ethnographic Overview

At the time of European contact, California was the home of approximately 310,000 indigenous peoples with a complex of cultures distinguished by linguistic affiliation and territorial boundaries (Kroeber 1925, Cook 1978, Heizer 1978a, Ortiz 1983, d'Azevedo 1986). At least 70 distinct native Californian cultural groups, with even more subgroups, inhabited the vast lands within the State. The groups and subgroups spoke between 74 and 90 languages, plus a large number of dialects (Shipley 1978: p. 80, University of California at Berkeley 2009-2010).

In general, these mainly sedentary, complex hunter-gatherer groups of indigenous Californians shared similar subsistence practices (hunting, fishing, and collecting plant foods), settlement patterns, technology, material culture, social organization, and religious beliefs (Kroeber 1925, Heizer 1978a, Ortiz 1983, d'Azevedo 1986). Permanent villages were situated along the coast, interior waterways, and near lakes and wetlands. Population density among these groups varied, depending mainly on availability and dependability of local resources, with the highest density of people in the northwest coast and Santa Barbara Channel areas and the least in the State's desert region (Cook 1976). Networks of foot trails were used to connect groups to hunting or plant gathering areas, rock quarries, springs or other water sources, villages, ceremonial places, or distant trade networks (Heizer 1978b).

The social organization of California's native peoples varied throughout the State, with villages or political units generally organized under a headman who was also the head of a lineage or extended family or achieved the position through wealth (Bean 1978). For some groups, the headman also functioned as the religious ceremonial leader. Influenced by their Northwest Coast neighbors, the differential wealth and power of individuals was the basis of social stratification and prestige between elites and commoners for the Chilula, Hupa, Karok, Tolowa, Wiyot, and Yurok in the northwest corner of the State. Socially complex groups were also located along the southern California coast where differential wealth resulted in hierarchical classes and hereditary village chiefs among the Chumash, Gabrielino, Juaneño, and Luiseño (Bean and Smith 1978, Arnold and Graesch 2004).

At the time of Spanish contact, religious practices among native Californian groups varied, but ethnographers have recognized several major religious systems (Bean and Vane 1978: pp. 662-669). Many of the groups in the north-central part of the State practiced the *Kuksu* cult, primarily a ceremonial and dance organization, with a powerful shaman as the leader. Log drums, flutes, rattles, and whistles accompanied the elaborate ceremonial dances. The World Renewal cult in the northwestern corner of the State extended as far north as Alaska, entailed a variety of annual rites to prevent natural disasters, maintain natural resources and individual health, and were funded by

the wealthy class. The *Toloache* cult was widespread in central and southern California and involved the use of narcotic plant (commonly known as datura or jimsonweed) materials to facilitate the acquisition of power. On the southern coast among Takic-speaking groups, the basis of Gabrielino, Juaneño, and Luiseño religious life was the *Chinigchinich* cult, which appeared to have developed from the Toloache cult. Chinigchinich, the last of a series of heroic mythological figures, gave instruction on laws and institutions, taught people how to dance, and later withdrew into heaven where he rewarded the faithful and punished those who disobeyed his laws. The Chinigchinich religion seems to have been relatively new when the Spanish arrived, and could have been influenced by Christianity.

Trade and exchange networks were a significant part of the economy and social organization among California's Native American groups (Heizer 1978b). Obsidian, steatite, beads, acorns, baskets, animal skins, and dried fish were among the variety of traded commodities. Inland groups supplied obsidian from sources along the Sierra Nevada Mountains, in Napa Valley, and in the northeast corner of the State. Coastal groups supplied marine shell beads, ornaments, and marine mammal skins. In addition to trading specific items, clamshell disk beads made from two clam species available on the Pacific coast were widely used as a form of currency (Kroeber 1922). In northwestern California, groups used strings of dentalium shell as currency.

The effect of Spanish settlement and missionization in California marks the beginning of a devastating disruption of native culture and life ways, with forced population movements, loss of land and territory (including traditional hunting and gathering locales), enslavement, and decline in population numbers from disease, malnutrition, starvation, and violence during the historic period (Castillo 1978). In the 1830s, foreign disease epidemics swept through the densely populated Central Valley, adjacent foothills, and North Coast Ranges decimating indigenous population numbers (Cook 1978). By 1850, with their lands, resources and way of life being overrun by the steady influx of non-native people during the Gold Rush, California's native population was reduced to about 100,000; by 1900, there were only 20,000 or less than seven percent of the pre-contact number. Existing reservations were created in California by the federal government beginning in 1858 but encompass only a fraction of native lands.

In 2004, the Native American population in California was estimated at over 383,000 (OPR 2005). Although acknowledged as non-federally recognized California Native American tribes on the contact list maintained by the Native American Heritage Commission (NAHC), many groups continue to await federal tribal status recognition. As of 2005, there were 109 federally recognized tribes within the state, along with dozens of non-federally recognized tribes. Members of these tribes have specific cultural beliefs and traditions with unique connections to areas of California that are their ancestral homelands.

c) Historic Overview

Post-contact history for the State is generally divided into the Spanish period (1769–1822), Mexican period (1822–1848), and American period (1848–present). The

establishment of Fort Ross by Alaska-based Russian traders also influenced post-contact history for a short period (1809–1841) in the region north of San Francisco Bay. Although there were brief visits along the Pacific coast by European explorers (Spanish, Russian, and British) between 1529 and 1769 of the territory claimed by Spain, the expeditions did not journey inland.

i) Spanish Period (1769–1822)

Spain's colonization of California began in 1769 with the overland expeditions from San Diego to San Francisco Bay by Lt. Colonel Gaspar de Portolá, and the establishment of a mission and settlement at San Diego. Between 1769 and 1823, the Spanish and the Franciscan Order established a series of 21 missions paralleling the coast along El Camino Real between San Diego and Sonoma (Rolle 1969). Between 1769 and 1782, Spain built four presidios (San Diego, Monterey, San Francisco, and Santa Barbara) to protect the missions, and by 1871 had established two additional pueblos at Los Angeles and San José.

Under Spanish law, large tracts of land, including cattle ranches and farms, fell under the jurisdiction of the missions. Native Americans were removed from their traditional lands, converted to Christianity, concentrated at the missions, and used as labor on the mission farms and ranches (Castillo 1978). Since the mission friars had civil as well as religious authority over their converts, they held title to lands in trust for indigenous groups. The lands were to be repatriated once the native peoples learned Spanish laws and culture.

ii) Russian Period (1809–1841)

In 1809, Alaska-based Russians started exploring the northern California coast with the goal of hunting otter and seal and feeding their Alaskan colonies. The first Russian settlement, was established in 1811–1812 by the Russian–American Fur Company to protect the lucrative marine fur trade and to grow produce for their Alaskan colonies. In 1841, as a result of the decline in local sea otter population and the failure of their agricultural colony, combined with a change in international politics, the Russians withdrew from California (Schuyler 1978).

iii) Mexican Period (1822–1848)

Following independence from Spain in 1822, the economy during the Mexican period depended on the extensive rancho system, carved from the former Franciscan missions and at least 500 land grants awarded in the State's interior to Mexican citizens (Beck and Haase 1974; Staniford 1975). Captain John Sutter, who became a Mexican citizen, received the two largest land grants in the Sacramento Valley. In 1839, Sutter founded the trading and agricultural empire named New Helvetia that was headquartered at Sutter's Fort, near the confluence of the Sacramento and American Rivers in today's City of Sacramento (Hoover et al. 2002).

Following adoption of the Secularization Act of 1833, the Mexican government privatized most Franciscan lands, including holdings of their California missions. Although secularization schemes had called for redistribution of lands to Native

American neophytes who were responsible for construction of the mission empire, the vast mission lands and livestock holdings were instead redistributed by the Mexican government through several hundred land grants to private, non-indigenous ranchers (Castillo 1978, Hoover et al. 2002). Most Native American converts returned to traditional lands that had not yet been colonized or found work with the large cattle ranchos being carved out of the mission lands.

iv) American Period (1848–present)

In 1848, shortly after California became a territory of the United States with the signing of the Treaty of Guadalupe Hidalgo ending Mexican rule, gold was discovered on the American River at Sutter's Mill in Coloma. The resulting Gold Rush era influenced the history of the State, the nation, and the world. Thousands of people flocked to the gold fields in the Mother Lode region that stretches along the western foothills of the Sierra Nevada Mountains, and to the areas where gold was also discovered in other parts of the State, such as the Klamath and Trinity River basins (Caltrans 2008). In 1850, California became the 31st state, largely as a result of the Gold Rush.

2. Paleontological Setting

a) Statewide Overview

California's fossil record is exceptionally prolific with abundant specimens representing a diverse range of marine, lacustrine, and terrestrial organisms recovered from Precambrian rocks as old as 1 billion years to as recent as 6,000 year-old Holocene deposits (refer to geologic timescale in Table 6). These fossils provide key data for charting the course of the evolution or extinction of a variety of life on the planet, both locally and internationally. Paleontological specimens also provide key evidence for interpreting paleoenvironmental conditions, sequences and timing of sedimentary deposition, and other critical components of the earth's geologic history. Fossils are considered our most significant link to the biological prehistory of the earth (Jefferson 2004).

Table 6: Divisions of Geologic Time

Era	Period	Time in Millions of Years Ago (approximately)	Epoch
Cenozoic	Quaternary	< 0.01	Holocene
		2.6	Pleistocene
	Tertiary	5.3	Pliocene
		23	Miocene
		34	Oligocene
		56	Eocene
		65	Paleocene
Mesozoic	Cretaceous	145	
	Jurassic	200	

Table 6: Divisions of Geologic Time			
Era	**Period**	**Time in Millions of Years Ago (approximately)**	**Epoch**
	Triassic	251	
Paleozoic	Permian	299	
	Carboniferous	359	
	Devonian	416	
	Silurian	444	
	Ordovician	488	
	Cambrian	542	
Precambrian		2,500	
Source: USGS Geologic Names Committee 2010			

Because the majority of the State was underwater until the Tertiary period, marine fossils older than 65 million years are not common and are exposed mainly in the mountains along the border with Nevada and the Klamath Mountains, and Jurassic shales, sandstones, and limestones are exposed along the edges of the Central Valley, portions of the Coast, Transverse, and Peninsular Ranges, and the Mojave and Colorado Deserts. Some of the oldest fossils in the State, extinct marine vertebrates called conodonts, have been identified at Anza-Borrego Desert SP in Ordovician sediments dating to circa 450 million years ago. Limestone outcrops of Pennsylvanian and Permian in the Providence Mountains SRA contain a variety of marine life, including brachiopods, fusulinids, crinoids, that lived some 300 to 250 million years ago.

Fossils from the Jurassic sedimentary layers in San Joaquin, San Luis Obispo, and Stanislaus counties include ammonites, bivalves, echinoderms and marine reptiles, all of which were common in the coastal waters. Gymnosperms (seed-bearing plants) such as cycads, conifers, and ginkgoes are preserved in terrestrial sediments from this period, evidence that the Jurassic climate was warm and moderately wet. In the great Central Valley, marine rocks record the position of the Cretaceous shoreline as the eroded ancestral Sierra Nevada sediments were deposited east of the rising Coast Ranges and became the rock layers of the Sacramento and San Joaquin valleys. These Cretaceous sedimentary deposits have yielded abundant fossilized remains of plants, bivalves, ammonites, and marine reptiles (Paleontology Portal 2003).

Along coastal southern California where steep coastal mountains plunged into the warm Pacific Ocean an abundance of fossil marine invertebrates, such as ammonites, nautilus, tropical snails and sea stars, have been found in today's coastal and near-coastal deposits from the Cretaceous Period. A rare armored dinosaur fossil dated to about 75 million years ago during the Cretaceous was discovered in San Diego County during a highway project. It is the most complete dinosaur skeleton ever found in California (San Diego Natural History Museum 2010). The lack of fossil remains of the

majority of earth's large vertebrates, particularly terrestrial, marine, and flying reptiles (dinosaurs, ichthyosaurs, mosasaurs, pleisosaurs, and pterosaurs), as well as many species of terrestrial plants, after the end of the Cretaceous and the start of the Tertiary periods 65 million years ago (the K-T boundary) attests to their abrupt extinction.

B. Regulatory Setting

Table 7: Applicable Laws and Regulations for Cultural Resources

Applicable Regulation	Description
Federal	
NHPA of 1966	The NHPA requires federal agencies to consider the preservation of historic and prehistoric resources. The Act authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places (NRHP), and it establishes an Advisory Council on Historic Preservation (ACHP) as an independent federal entity. Section 106 of the Act requires federal agencies to take into account the effects of their undertakings on historic properties and afford the ACHP a reasonable opportunity to comment on the undertaking prior to licensing or approving the expenditure of funds on any undertaking that may affect properties listed, or eligible for listing, in the NRHP.
National Environmental Policy Act (NEPA) of 1969	NEPA requires federal agencies to foster environmental quality and preservation. Section 101(b) (4) declares that one objective of the national environmental policy is to "preserve important historic, cultural, and natural aspects of our national heritage." Foray major federal actions significantly affecting environmental quality, federal agencies must prepare, and make available for public comment, an environmental impact statement.
Archaeological Resources Protection Act of 1979 (NRPA)(16 USC 470aa-470II)	NRPA requires a permit for any excavation or removal of archaeological resources from public lands or Indian lands. The statute provides both civil and criminal penalties for violation of permit requirements and for excavation or removal of protected resources without a permit.
Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (PL 101–601)	NAGPRA vests ownership or control of certain human remains and cultural items, excavated or discovered on federal or tribal lands, in designated Native American tribes, organizations, or groups. The Act further: requires notification of the appropriate Secretary or other head of any federal agency upon the discovery of Native American cultural items on federal or tribal lands; proscribes trafficking in Native American human remains and cultural items; requires federal agencies and museums to compile an inventory of Native American human remains and associated funerary objects, and to notify affected Indian tribes of this inventory; and provides for the repatriation of Native

Table 7: Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
	American human remains and specified objects possessed or controlled by federal agencies or museums.
Advisory Council Regulation, Protection of Historic Properties (SHPO) (36 CFR 800)	Establishes procedures for compliance with Section 106 of the National Historic Preservation Act of 1966. These regulations define the Criteria of Adverse Effect, define the role of State Historic Preservation Officer (SHPO) in the Section 106 review process, set forth documentation requirements, and describe procedures to be followed if significant historic properties are discovered during implementation of an undertaking. Prehistoric and historic resources deemed significant (i.e., eligible for listing in the NRHP, per 36 CFR 60.4) must be considered in project planning and construction. The responsible federal agency must submit any proposed undertaking that may affect NRHP-eligible properties to the SHPO for review and comment prior to project approval.
National Park Service Regulations, National Register of Historic Places (NRHP) (36 CFR 60)	Sets forth procedures for nominating properties to the NRHP, and present the criteria to be applied in evaluating the eligibility of historic and prehistoric resources for listing in the NRHP.
Archaeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines (FR 190:44716–44742)	Non-regulatory technical advice about the identification, evaluation, documentation, study, and other treatment of cultural resources. Notable in these Guidelines are the "Standards for Archaeological Documentation" (p. 44734) and "Professional Qualifications Standards for Archaeology" (pp. 44740–44741).
American Indian Religious Freedom Act of 1978	The American Indian Religious Freedom Act pledges to protect and preserve the traditional religious rights of American Indians, Aleuts, Eskimos, and Native Hawaiians. Before the act was passed, certain U.S. federal laws interfered with the traditional religious practices of many American Indians. The Act establishes a national policy that traditional Native American practices and beliefs, sites (and right of access to those sites), and the use of sacred objects shall be protected and preserved.
Department of Transportation Act of 1966, Section 4(f)	Section 4(f) of the Act requires a comprehensive evaluation of all environmental impacts resulting from federal-aid transportation projects administered by the Federal Highway Administration (FHA), Federal Transit Administration (FTA), and Federal Aviation Administration (FAA) that involve the use—or interference with use—of several types of land: public park lands, recreation areas, and publicly or privately owned historic properties of federal, state, or local significance. The Section 4(f) evaluation must be sufficiently detailed to permit the U.S.

Table 7: Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
	Secretary of Transportation to determine that there is no feasible and prudent alternative to the use of such land, in which case the project must include all possible planning to minimize harm to any park, recreation, wildlife and waterfowl refuge, or historic site that would result from the use of such lands. If there is a feasible and prudent alternative, a proposed project using Section 4(f) lands cannot be approved by the Secretary. Detailed inventories of the locations and likely impacts on resources that fall into the Section 4(f) category are required in project-level environmental assessments.
State	
California Health and Safety Code Section and California PRC, Section	Disturbance of human remains without the authority of law is a felony (California Health and Safety Code, Section 7052). According to State law (California Health and Safety Code, Section 7050.5, California PRC, Section 5097.98), if human remains are discovered or recognized in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until 1) the coroner of the county has been informed and has determined that no investigation of the cause of death is required; 2)and if the remains are of Native American origin, and if the descendants from the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of with appropriate dignity the human remains and any associated grave goods as provided in PRC Section 5097.98; or the Native American Heritage Commission was unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the Commission. According to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the Native American Heritage Commission, who has jurisdiction over Native American remains (California Health and Safety Code, 7052.5c; PRC, Section 5097.98).
Local	
City/County General	Policies, goals, and implementation measures in county or city

Table 7: Applicable Laws and Regulations for Cultural Resources	
Applicable Regulation	**Description**
Plans	general plans may contain measures applicable to cultural and paleontological resources. In addition to the enactment of local and regional preservation ordinances, CEQA requires that resources included in local registers be considered (pursuant to section 5020.1(k) of the PRC).Therefore, local county and municipal policies, procedures, and zoning ordinances must be considered in the context of project-specific undertakings. Cultural resources are generally discussed in either the Open Space Element or the Conservation Element of the General Plan. Many local municipalities include cultural resources preservation elements in their general plans that include some mechanism pertaining to cultural resources in those communities. In general, the sections pertaining to archaeological and historical properties are put in place to afford the cultural resources a measure of local protection. The policies outlined in the individual general plans should be consulted prior to any undertaking or project.
Cooperative Agreements Among Agencies	Cooperative agreements among land managing agencies (BLM, National Park Service, U.S. Forest Services, California State Parks, Bureau of Indian Affairs, Department of Defense, to name a few) the SHPO and ACHP may exist and will need to be complied with on specific projects. In addition, certain agencies have existing Programmatic Agreements (PA) requiring permits (California Public Utilities Commission [CPUC], BLM) to complete archaeological investigations and employ the Secretary of Interior's Professional Qualification Standards and Guidelines (36 CFR 61).

5.0 ENERGY DEMAND

A. Existing Conditions

The major energy sources consumed in the United States are petroleum (oil), natural gas, coal, nuclear, and renewable energy. The major users are residential and commercial buildings, industry, transportation, and electric power generators. The pattern of fuel use varies widely by sector. For example, oil provides 93 percent of the energy used for transportation, but only about 1 percent of the energy used to generate electric power (U.S. EIA 2013a).

Excluding Federal offshore areas, California ranks third in the Nation in crude oil production and refining capacity in 2011. California ranks third in the Nation in conventional hydroelectric generation, first in net electricity generation from other renewable energy resources, and first as a producer of electricity from geothermal

energy (in 2011). In 2010, California, with two nuclear power plants, ranked tenth in net electricity generation from nuclear power plants and eighth in nuclear net summer capacity. Average site electricity consumption in California homes is among the lowest in the nation (6.9 megawatt hours per year), according to EIA's Residential Energy Consumption Survey. In 2010, California's per capita energy consumption ranked 48th in the Nation, due in part to its mild climate and energy efficiency programs (EIA 2013b).

In 2010, California's in-state electricity generation sources consisted of: 53.4 percent natural gas, 15.7 percent nuclear, 14.6 percent large hydropower, 14.6 renewable sources, and 1.7 percent from coal. Approximately 71 percent of total electricity generation was from in-state sources, with the remaining electricity coming from out-of-state imports from the Pacific Northwest (8 percent) and the Southwest (21 percent). (CEC 2011a)

On the demand side, in 2010, Californians consumed 272,300 gigawatt hours (GWh) of electricity and 12,700 million therms of natural gas, primarily in the commercial, residential, and industrial sectors. A California Energy Commission (CEC) staff forecast of future energy demand shows that electricity consumption will grow by between 1.18 and 1.68 percent per year between 2012 and 2022; and natural gas consumption is expected to reach up to 14,175 million therms by 2022 for an annual average growth rate of up to 0.94 percent (CEC 2011b).

The CEC is the State's primary energy policy and planning agency. Created by the Legislature in 1974, and located in Sacramento, six basic responsibilities guide the CEC as it sets state energy policy: forecasting future energy needs; promoting energy efficiency and conservation by setting the State's appliance and building efficiency standards; supporting public interest energy research that advances energy science and technology through research, development and demonstration programs; developing renewable energy resources and alternative renewable energy technologies for buildings, industry and transportation; licensing thermal power plants 50 megawatts or larger; and planning for and directing state response to energy emergencies.
The CPUC also plays a key role in regulating investor-owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies. The CPUC regulates investor-owned electric and natural gas utilities operating in California, including Pacific Gas and Electric Company, Southern California Edison, San Diego Gas and Electric Company, and Southern California Gas Company.

B. Regulatory Setting

Table 8: Applicable Laws and Regulations for Energy Demand	
Regulation	**Description**
Federal	
Energy Policy and Conservation Act	The Energy Policy and Conservation Act of 1975 sought to ensure that all vehicles sold in the U.S. would meet certain fuel economy goals. Through this Act, Congress established the first fuel economy standards for on-road motor vehicles in the United

Table 8: Applicable Laws and Regulations for Energy Demand	
Regulation	**Description**
	States. Pursuant to the Act, the National Highway Traffic and Safety Administration, which is part of the U.S. Department of Transportation (USDOT), is responsible for establishing additional vehicle standards and for revising existing standards. Since 1990, the fuel economy standard for new passenger cars has been 27.5 mpg. Since 1996, the fuel economy standard for new light trucks (gross vehicle weight of 8,500 pounds or less) has been 20.7 mpg. Heavy-duty vehicles (i.e., vehicles and trucks over 8,500 pounds gross vehicle weight) are not currently subject to fuel economy standards. Compliance with federal fuel economy standards is determined on the basis of each manufacturer's average fuel economy for the portion of its vehicles produced for sale in the U.S. The Corporate Average Fuel Economy (CAFE) program, administered by the US EPA, was created to determine vehicle manufacturers' compliance with the fuel economy standards. The US EPA calculates a CAFE value for each manufacturer based on city and highway fuel economy test results and vehicle sales. Based on the information generated under the CAFE program, the USDOT is authorized to assess penalties for noncompliance.
Energy Policy Act (EPAct) of 1992	EPAct was passed to reduce the country's dependence on foreign petroleum and improve air quality. EPAct includes several parts intended to build an inventory of alternative fuel vehicles (AFVs) in large, centrally fueled fleets in metropolitan areas. EPAct requires certain federal, state, and local government and private fleets to purchase a percentage of light duty AFVs capable of running on alternative fuels each year. In addition, financial incentives are included in EPAct. Federal tax deductions will be allowed for businesses and individuals to cover the incremental cost of AFVs. States are also required by the act to consider a variety of incentive programs to help promote AFVs.
Energy Policy Act of 2005	The Energy Policy Act of 2005 was signed into law on August 8, 2005. Generally, the act provides for renewed and expanded tax credits for electricity generated by qualified energy sources, such as landfill gas; provides bond financing, tax incentives, grants, and loan guarantees for a clean renewable energy and rural community electrification; and establishes a federal purchase requirement for renewable energy.
State	
Warren-Alquist State Energy Resources Conservation and Development Act	The Warren-Alquist Act is the legislation that created and gives statutory authority to the California Energy Commission (formally called the State Energy Resources Conservation and Development Commission).

Table 8: Applicable Laws and Regulations for Energy Demand	
Regulation	**Description**
of 1974	
Integrated Energy Policy Reports (SB 1389)	Senate Bill 1389 (Bowen, Chapter 568, Statutes of 2002) requires the California Energy Commission to prepare a biennial integrated energy policy report that contains an assessment of major energy trends and issues facing the State's electricity, natural gas, and transportation fuel sectors and provides policy recommendations to conserve resources; protect the environment; ensure reliable, secure, and diverse energy supplies; enhance the State's economy; and protect public health and safety (Pub. Resources Code, § 25301,subd. (a)). The Energy Commission prepares these assessments and associated policy recommendations every two years, with updates in alternate years, as part of the Integrated Energy Policy Report (IEPR). Preparation of the IEPR involves close collaboration with federal, state, and local agencies and a wide variety of stakeholders in an extensive public process to identify critical energy issues and develop strategies to address those issues (CEC 2012a).
California Long-Term Energy Efficiency Strategic Plan	On Sept. 18, 2008, the CPUC adopted California's first Long Term Energy Efficiency Strategic Plan, presenting a single roadmap to achieve maximum energy savings across all major groups and sectors in California. This comprehensive Plan for 2009 to 2020 is the State's first integrated framework of goals and strategies for saving energy, covering government, utility, and private sector actions, and holds energy efficiency to its role as the highest priority resource in meeting California's energy needs. The plan was updated in January 2011 to include a lighting chapter.
California Building Energy Efficiency Standards (CCR Title 24, Part 6)	California's Building Energy Efficiency Standards (Title 24, Part 6 of the California Code of Regulations) conserve electricity and natural gas in new building construction and are administered by the CEC. Local governments enforce the standards through local building permitting and inspections. The CEC has updated these standards on a periodic basis. The new 2013 Building Energy Efficiency Standards, which take effect on January 1, 2014, are 25 percent more efficient than previous standards for residential construction and 30 percent more efficient for nonresidential construction.
Comprehensive Energy Efficiency Plan for Existing Buildings (AB 758)	Assembly Bill 758 (Skinner, Chapter 470, Statutes 2009) requires the CEC, in collaboration with the CPUC and stakeholders, to develop a comprehensive program to achieve greater energy efficiency in the State's existing buildings.
California Renewable Energy Portfolio Standard	In 2011, Governor Brown signed SB X1-2, which requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to provide at least 33 percent of

Table 8: Applicable Laws and Regulations for Energy Demand	
Regulation	**Description**
(RPS) (SB X1-2)	their electricity supply (portfolio) from renewable sources by 2020. The CPUC and the CEC jointly implement the Statewide RPS program through rulemakings and monitoring the activities of electric energy utilities in the state.
California Qualifying Facility and Combined Heat and Power Program Settlement	In December 2010, the CPUC approved California's Qualifying Facility and Combined Heat and Power Program Settlement, which established a CHP framework for the State's investor-owned utilities. The settlement established a near-term target of 3,000 megawatts (MW) of CHP for entities under the jurisdiction of the CPUC, although this target includes not just new CHP, but capacity from renewal of contracts due to expire in the next three years. The CPUC has also adopted a settlement agreement that includes reforms to the Rule 21 interconnection process to provide a clear, predictable path to interconnection of distributed generation while maintaining the safety and reliability of the grid (CEC 2012).
California Appliance Efficiency Regulations (CCR, Title 20)	California's Appliance Efficiency Regulations, enacted in 1976, requires that certain appliances meet efficiency standards. Each appliance must be tested and the results certified by the CEC in order for a product can be sold in California (CEC 2012b).
Alternative and Renewable Fuel and Vehicle Technology Program	Assembly Bill 118 (Statues of 2007) created the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program. The statute, subsequently amended by Assembly Bill 109 (Statues of 2008), authorizes the CEC to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the State's climate change policies.

6.0 GEOLOGY AND SOILS

A. Existing Conditions

The State's topography is highly varied and includes 1,340 miles of seacoast, as well as high mountains, inland flat valleys, and deserts. Elevations in California range from 282 feet below sea level in Death Valley to 14,494 feet at the peak of Mount Whitney. The mean elevation of California is approximately 2,900 feet. The climate of California is as highly varied as its topography. Depending on elevation, proximity to the coast, and altitude, climate types include temperate oceanic, highland, sub-arctic, Mediterranean, steppe, and desert (USGS 1995). The average annual precipitation across all California climate types is approximately 23 inches and approximately 75 percent of the State's annual precipitation falls between November and March, primarily in the form of rain,

with the exception of high mountain elevations (DWR 2003). Average annual precipitation ranges from more than 100 inches in the mountainous areas within the Smith River in Del Norte County to less than 2 inches in Death Valley, illustrating the extreme differences in precipitation levels within the State (Mount 1995). Overall, northern California is wetter than southern California with the majority of the State's annual precipitation occurring in the northern coastal region.

1. Geology

Plate tectonics and climate have played major roles in forming California's dramatic landscape. California is located on the active western boundary of the North American continental plate in contact with the oceanic Pacific Plate and the Gorda Plate north of the Mendocino Triple Junction. The dynamic interactions between these three plates and California's climate are responsible for the unique topographic characteristics of California, including rugged mountain ranges, long and wide flat valleys, and dramatic coastlines (Harden 1997). Tectonics and climate also have a large effect on the occurrence natural environmental hazards, such as earthquakes, landslides, and volcanic formations.

a) Landslides

Landsliding or mass wasting is a common erosional process in California and has played an integral part in shaping the State's landscape. Typically, landslides occur in mountainous regions of the State, but they can also occur in areas of low relief, including coastal bluffs, along river and stream banks, and inland desert areas. Landsliding is the gravity-driven downhill mass movement of soil, rock, or both and can vary considerably in size, style and rate of movement, and type depending on the climate of a region, the steepness of slopes, rock type and soil depth, and moisture regime (Harden 1997).

b) Earthquakes

Earthquakes are a common and unpredictable occurrence in California. The tectonic development of California began millions of years ago by a shift in plate tectonics that converted the passive margin of the North American plate into an active margin of compressional and translational tectonic regimes. This shift in plate tectonics continues to make California one of the most geomorphically diverse, active, and picturesque locations in the U.S. While some areas of California are more prone to earthquakes, such as northern, central, and southern coastal areas of California, all areas of California are prone to the effects of ground shaking due to earthquakes. While scientists have made substantial progress in mapping earthquake faults where earthquakes are likely to occur, and predicting the potential magnitude of an earthquake in any particular region, they have been unable to precisely predict where or when an earthquake will occur and what its magnitude will be.

c) Tsunamis

Coastal communities around the circum Pacific have long been prone to the destructive effects of tsunamis. Tsunamis are a series of long-period, high-magnitude ocean waves that are created when an outside force displaces large volumes of water. Throughout time, major subduction zone earthquakes in both the Northern and Southern Hemispheres have moved the Earth's crust at the ocean bottom sending vast amounts of waters into motion and spreading tsunami waves throughout the Pacific Ocean.

Tsunamis can also occur from subareal and submarine landslides that displace large volumes of water. Subaeral landslide-generated tsunamis can be caused by seismically generated landslides, rock falls, rock avalanches, and eruption or collapse of island or coastal volcanoes. Submarine landslide-generated tsunamis are typically caused by major earthquakes or coastal volcanic activity. In contrast to a seismically generated tsunami, seismic seiches are standing waves that are caused by seismic waves traveling through a closed (lake) or semi-enclosed (bay) body of water. Due to the long-period seismic waves that originate after an earthquake, seiches can be observed several thousand miles away from the origin of the earthquakes. Small bodies of water, including lakes and ponds, are especially vulnerable to seismic seiches.

d) Volcanoes

A volcano is an opening in the Earth's crust through which magma escapes to the surface where it is extruded as lava. Volcanism may be spectacular, involving great fountains of molten rock, or tremendous explosions that are caused by the build-up of gases within the volcano (Ritchie and Gates 2001). Some of the most active volcanic areas in California are located within the Cascade Range - a volcanic chain that is a result of compressional tectonics along the Cascadia subduction zone.

e) Active Faults

A fault is defined as a fracture or zone of closely associated fractures along rocks that on one side have been displaced with respect to those on the other side. Most faults are the result of repeated displacement that may have taken place suddenly or by slow creep. A fault is distinguished from fractures or shears caused by landsliding or other gravity-induced surficial failures. A fault zone is a zone of related faults that commonly are braided and subparallel, but may be branching and divergent. A fault zone has significant width (with respect to the scale of the fault being considered, portrayed, or investigated), ranging from a few feet to several miles (Bryant and Hart 2007).

In the State of California earthquake faults have been designated as being active through a process that has been described by the1972 Alquist-Priolo Earthquake Fault Zoning Act. An active fault is defined by the State as one that has "had surface displacement within Holocene time (about the last 11,000 years)." This definition does not, of course, mean that faults lacking evidence for surface displacement within Holocene time are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity sometimes is difficult to obtain and locally may not exist.

B. Regulatory Setting

Table 9: Applicable Laws and Regulations for Geology and Soils	
Regulation	**Description**
Federal	
Safe Drinking Water Act - Federal Underground Injection Control Class VI Program for Carbon Dioxide Geology Sequestration Wells	Under the Safe Drinking Water Act (SDWA), the Federal Underground Injection Control (UIC) Class VI Program for Carbon Dioxide Geologic Sequestration Wells requires states and owners or operators to submit all permit applications to the appropriate EPA Region in order for a Class VI permit to be issued. These requirements, also known as the Class VI rule, are designed to protect underground sources of drinking water. The Class VI rule builds on existing UIC Program requirements, with extensive tailored requirements that address carbon dioxide injection for long-term storage to ensure that wells used for geologic sequestration are appropriately sited, constructed, tested, monitored, funded, and closed. The rule also affords owners or operators injection depth flexibility to address injection in various geologic settings in the United States in which geologic sequestration may occur, including very deep formations and oil and gas fields that are transitioned for use as carbon dioxide storage sites.
CWA	This law was enacted to restore and maintain the chemical, physical, and biological integrity of the nation's waters by regulating point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands. This includes the creation of a system that requires states to establish discharge standards specific to water bodies (National Pollution Discharge Elimination System [NPDES]), which regulates storm water discharge from construction sites through the implementation of a Storm Water Pollution Prevention Plan (SWPPP). In California, the State's NPDES permit program is implemented and administered by the local Regional Water Quality Control Boards.
Earthquake Hazards Reduction Act and National Earthquake Hazards Reduction Program Act	This Act established the National Earthquake Hazards Reduction Program to reduce the risks to life and property from future earthquakes. This program was significantly amended in November 1990 by the National Earthquake Hazards Reduction Program Act by refining the description of agency responsibilities, program goals and objectives.
State	
Seismic Hazards Mapping Act, PRC Section 2690–2699.	The Seismic Hazards Mapping Act (the Act) of 1990 (PRC, Chapter 7.8, Division 2) directs the California DOC, Division of Mines and Geology (now called California Geological Survey

Table 9: Applicable Laws and Regulations for Geology and Soils	
Regulation	**Description**
	[CGS]) to delineate Seismic Hazard Zones. The purpose of the Act is to reduce the threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards. These include areas identified that are subject to the effects of strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches. Cities, counties, and state agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. The Act requires that site-specific geotechnical investigations be performed prior to permitting most urban development projects within seismic hazard zones.
California Division of Oil, Gas, and Geothermal Resources (DOGGR), PRC Section 3106.	PRC Section 3106 mandates the supervision of drilling, operation, maintenance, and abandonment of oil wells for the purpose of preventing: damage to life, health, property, and natural resources; damage to underground and surface waters suitable for irrigation or domestic use; loss of oil, gas, or reservoir energy; and damage to oil and gas deposits by infiltrating water and other causes. In addition, the DOGGR regulate drilling, production, injection, and gas storage operations in accordance with CCR Title 14, Chapter 4, Subchapter 1.
Landslide Hazard Identification Program, PRC Section 2687(a)	The Landslide Hazard Identification Program requires the State Geologist to prepare maps of landslide hazards within urbanizing areas. According to PRC Section 2687(a), public agencies are encouraged to use these maps for land use planning and for decisions regarding building, grading, and development permits.
California Building Standards Code (CBSC) (CCR Title 24)	California's minimum standards for structural design and construction are given in the CBSC (CCR Title 24). The CBSC is based on the Uniform Building Code (International Code Council 1997), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, proponents of specific projects would be required to comply with all provisions of the CBSC for certain aspects of design and construction.
California Department of Transportation (Caltrans) Seismic	Caltrans has SDC, which is an encyclopedia of new and currently practiced seismic design and analysis methodologies for the design of new bridges in California. The SDC adopts a performance-based approach specifying minimum levels of

Table 9: Applicable Laws and Regulations for Geology and Soils	
Regulation	**Description**
Design Criteria (SDC)	structural system performance, component performance, analysis, and design practices for ordinary standard bridges. The SDC has been developed with input from the Caltrans Offices of Structure Design, Earthquake Engineering and Design Support, and Materials and Foundations. Memo 20-1 outlines the bridge category and classification, seismic performance criteria, seismic design philosophy and approach, seismic demands and capacities on structural components and seismic design practices that collectively make up Caltrans' seismic design methodology.
Local	
Geotechnical Investigation	Local jurisdictions typically regulate construction activities through a process that may require the preparation of a site-specific geotechnical investigation. The purpose of a site-specific geotechnical investigation is to provide a geologic basis for the development of appropriate construction design. Geotechnical investigations typically assess bedrock and Quaternary geology, geologic structure, soils, and the previous history of excavation and fill placement. Proponents of specific projects that require design of earthworks and foundations for proposed structures will need to prepare geotechnical investigations on the physical properties of soil and rock at the site prior to project design.
Local Grading and Erosion Control Ordinances	Many counties and cities have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit is typically required for construction-related projects. As part of the permit, project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of Best Management Practices (BMPs) similar to those contained in a SWPPP.
County General Plans (and EIR)	Some county General Plans provide a regulatory framework to address potential environmental impacts that may result from a proposed project. These include the General Plans for Solano, San Luis Obispo, Los Angeles, Kern, San Bernardino, Riverside, and Imperial counties.

7.0 GREENHOUSE GASES

A. Existing Conditions

1. Existing Climate

Climate is the accumulation of daily and seasonal weather events over a long period of time, whereas weather is defined as the condition of the atmosphere at any particular time and place (Ahrens 2003). Like its topography, California's climate is varied and tends toward extremes. Generally there are two seasons in California: 1) a long, dry summer, with low humidity and cool evenings and 2) a mild, rainy winter, except in the high mountains, where four seasons prevail and snow lasts from November to April. The one climatic constant for the state is summer drought.

California has four main climatic regions. Mild summers and winters prevail in central coastal areas, where temperatures are more equable than virtually anywhere else in the U.S. For example, differences between average summer and winter temperatures between San Francisco and Monterey for example are seldom more than 10°F (6°C). During the summer there are heavy fogs in San Francisco and all along the coast. Mountainous regions are characterized by milder summers and colder winters, with markedly low temperatures at high elevations. The Central Valley has hot summers and cool winters, while the Imperial Valley and eastern deserts are marked by very hot, dry summers, with temperatures frequently exceeding 100°F (38°C).

Average annual temperatures for the state range from 47°F (8°C) in the Sierra Nevada to 73°F (23°C) in the Imperial Valley. The highest temperature ever recorded in the U.S. was 134°F (57°C), registered in Death Valley on 10 July 1913. Death Valley has the hottest average summer temperature in the Western Hemisphere, at 98°F (37°C). The state's lowest temperature was -45°F (-43°C), recorded on 20 January 1937 at Boca, near the Nevada border.

Among the major population centers, Los Angeles has an average annual temperature of 63°F (17°C), with an average January minimum of 48°F (9°C) and an average July maximum of 75°F (24°C). San Francisco has an annual average of 57°F (14°C), with a January average minimum of 42°F (6°C) and a July average maximum of 72°F (22°C). The annual average in San Diego is 64°F (18°C), the January average minimum 49°F (9°C), and the July average maximum 76°F (24°C). Sacramento's annual average temperature is 61°F (16°C), with January minimums averaging 38°F (3°C) and July maximums of 93°F (34°C).

Annual precipitation varies from only 2 in (5 cm) in the Imperial Valley to 68 in (173 cm) at Blue Canyon, near Lake Tahoe. San Francisco had an average annual precipitation (1971–2000) of 20 in (51 cm), Sacramento 17.9 in (45.5 cm), Los Angeles 13.2 in (33.5 cm), and San Diego 10.8 in (27.4 cm). The largest one-month snowfall ever recorded in the US, 390 in (991 cm), fell in Alpine County in January 1911. Snow averages between

300 and 400 in (760 to 1,020 cm) annually in the high elevations of the Sierra Nevada, but is rare in the Central Valley and coastal lowlands.

Sacramento has the greatest percentage (73 percent) of possible annual sunshine among the State's largest cities; Los Angeles has 72 percent and San Francisco 71 percent. San Francisco is the windiest, with an average annual wind speed of 11 mph (18 km/hr). Tropical rainstorms occur often in California during the winter.

2. Attributing Climate Change—The Physical Scientific Basis

Climate change is a long-term shift in the climate of a specific location, region or planet. The shift is measured by changes in features associated with average weather, such as temperature, wind patterns, and precipitation. According to the Intergovernmental Panel on Climate Change (IPCC), a scientific body established by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP), available scientific evidence supports the conclusion that most of the increased average global temperatures since the mid-20th century is very likely due to human-induced increases in greenhouse gas (GHG) concentrations. GHGs, which are emitted from both natural and anthropogenic sources, include water vapor, carbon dioxide, methane, nitrous oxide, halocarbons, and ozone. These gases play a role in the "greenhouse effect" that helps regulate the temperature of the earth.

The current post-industrial warming trend differs alarmingly from past changes in the Earth's climate because GHG emissions are higher and warming is occurring faster than at any other time on record within the past 650,000 years. Historical long-term as well as decadal and inter-annual fluctuations in the Earth's climate resulted from natural processes such as plate tectonics, the Earth's rotational orbit in space, solar radiation variability, and volcanism. The current trend derives from an added factor: human activities, which have greatly intensified the natural greenhouse effect, causing global warming. GHG emissions from human activities that contribute to climate change include the burning of fossil fuels (such as coal, oil and natural gas), cutting down trees (deforestation) and developing land (land-use changes). The burning of fossil fuels emits GHGs into the atmosphere, while deforestation and land-use changes remove trees and other kinds of vegetation that store ("sequester") carbon dioxide. Emissions of GHGs due to human activities have increased globally since pre-industrial times, with an increase of 70 percent between 1970 and 2004 (IPCC 2007).

A growing recognition of the wide-ranging impacts of climate change has fueled efforts over the past several years to reduce GHG emissions. In 1997, the Kyoto Protocol set legally binding emissions targets for industrialized countries, and created innovative mechanisms to assist these countries in meeting these targets. The Kyoto Protocol took effect in 2004, after 55 parties to the Convention had ratified it (The UN Climate Change Convention and the Kyoto Protocol). Six major GHGs have been the focus of efforts to reduce emissions and are included in AB 32: carbon dioxide (CO_2),methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). They are regulated under the Kyoto Protocol. Nitrogen trifluoride

(NF_3) was later added to the list of important GHGs to reduce and codified in California statute.

The "global warming potential" (GWP) metric is used to convert all GHGs into "CO_2-equivalent" (CO_2e) units. Importantly, metrics such as GWP have been used as an exchange rate in multi-gas emissions policies and frameworks. Each gas's GWP is defined relative to CO_2. For example, N_2O's GWP is 310, meaning a unit mass of N_2O warms the atmosphere 310 times more than a unit mass of CO_2. SF_6 and PFCs have extremely long atmospheric lifetimes, resulting in their essentially irreversible accumulation in the atmosphere once emitted. However, in terms of quantity of emissions, CO_2 dominates world and U.S. GHG emissions.

Because the major GHGs have longer lives, they build up in the atmosphere so that past, present and future emissions ultimately contribute to total atmospheric concentrations. Thus, while reducing emissions of conventional air pollutants decreases their concentrations in the atmosphere in a relatively short time, atmospheric concentrations of the major GHGs can only be gradually reduced over years and decades. More specifically, the rate of emission of CO_2 currently greatly exceeds its rate of removal, and the slow and incomplete removal implies that small to moderate reductions in its emissions would not result in stabilization of CO_2 concentrations, but rather would only reduce the rate of its growth in coming decades. Many of the same activities that emit conventional air pollutants also emit GHGs (e.g., the burning of fossil fuels to produce electricity, heat or drive engines and the burning of biomass). Some conventional air pollutants also have greenhouse effects, for example, soot/black carbon and tropospheric ozone (see Short-Lived Climate Pollutants below).

3. Attributing Climate Change—Greenhouse Gas Emission Sources

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, utility, residential, commercial and agricultural sectors. In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation. Anthropogenic emissions of CO_2 are byproducts of fossil fuel combustion. CH_4, a potent GHG, resulting primarily from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions), is largely associated with fugitive emissions from oil and gas operations, natural gas transmission, agricultural practices, and landfills. N_2O is also largely attributable to agricultural practices nitrogen-based fertilizers) and soil management. CO_2 sinks, or reservoirs, include vegetation, soils, and the ocean, which absorb CO_2 through sequestration and dissolution, respectively, two of the most common processes of CO_2 sequestration.

California is the 12th to 16th largest emitter of CO_2 in the world (CEC 2006). California produced 484 million gross metric tons of CO_2e in 2004 (ARB 2009). CO_2 equivalent (CO_2e) is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse effect (i.e., GWP). The GWP is dependent on the lifetime, or persistence, of the gas

molecule in the atmosphere. For example, as described in Appendix C, "Calculation References," of the General Reporting Protocol of the California Climate Action Registry (CCAR 2009), 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 34 tons of CO_2 (IPCC 2013). Therefore, CH_4 is a much more potent GHG than CO_2. Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted.

The California GHG inventory compiles statewide anthropogenic GHG emissions and sinks. It includes estimates for CO_2, CH_4, N_2O, SF_6, NF_3, HFCs, and PFCs. The current inventory covers years 2000 to 2011 (available at http://www.arb.ca.gov/cc/inventory/data/data.htm).

California's gross emissions of greenhouse gases decreased by 6 percent from 478.4 million metric tons of CO_2e ($MMTCO_2e$) in 2001 to 448.1 $MMTCO_2e$ in 2011, with a maximum of 489.2 $MMTCO_2e$ in 2004. During the same period, California's population grew by 9 percent from 34.5 to 37.6 million people1. As a result, California's per capita GHG emissions have decreased over the last 11 years from 13.9 to 11.9 metric tons of CO_2e per person. In 2011, emissions continued to decrease for the transportation and electric power sectors. Emissions from all other sectors (e.g., industrial,) remained relatively flat or increased slightly from 2010.

4. Short-Lived Climate Pollutants

Climate policy and research have mainly concentrated on long-term climate change and controlling the long-lived GHGs. However, there is growing recognition within the scientific community that efforts to address climate change should also focus on near-term actions to reduce climate-warming substances with much shorter atmospheric lifetimes. These non-CO_2 pollutants, known as "short-lived climate pollutants" (SLCP), include tropospheric ozone, methane, HFCs, and black carbon.

From a global perspective, SLCPs represent nearly 40 percent of the total climate pollutant emissions. In California, their contribution is smaller at around 30 percent. SLCPs have relatively short lifetimes in the atmosphere, but have significant GWP, which represent the ability to trap heat relative to CO_2. Since SLCPs remain in the atmosphere for periods of only a few days to a few decades, reducing their emissions results in immediate benefits. Thus, controlling sources of SLCPs is a critical climate strategy for reducing the near-term rate of global warming, particularly in regions most vulnerable to climate change.

California has established a strong track record with significant SLCP reductions as a co-benefit to its long-standing programs to clean up the air and protect public health. These include diesel engine controls, advanced clean cars, restrictions on burning, development of a refrigerant management program, and landfill controls. ARB is currently pursuing additional actions to further reduce SLCP emissions. These include targeting research on SLCP emissions from various sources to help the State identify

specific cost-effective measures, and developing regulations where cost-effective techniques are clearer.

a) Tropospheric Ozone

Ozone is a highly reactive and unstable gas. Stratospheric ozone, a layer of ozone high up in the atmosphere, is beneficial and absorbs ultraviolet radiation. Tropospheric (ground-level) ozone is a major air and climate pollutant. Tropospheric ozone is the main component of smog and causes serious health effects such as asthma and lung disease. Tropospheric ozone also affects sensitive vegetation and ecosystems, including forests, parks, wildlife refuges and wilderness areas. Tropospheric ozone can act as a direct GHG and as an indirect controller of GHG lifetimes. As a strong oxidant, it affects the lifetimes and concentrations of atmospheric trace gases, including methane and HFCs.

Tropospheric ozone is not emitted directly into the air. It is created by photochemical reactions between NO_X and volatile organic compound (VOC) emissions from vehicles, industrial facilities, consumer products and many other sources.

Ozone has long been recognized as a significant local and regional air quality issue due to its impacts on human health and the environment. Federal clean air laws require areas with unhealthy levels of ozone to develop plans, known as State Implementation Plans (SIP). These plans include measures that describe how an area will attain federal ozone air quality standards. In addition to measures included in the SIP, the State has adopted several regulatory programs focused on controlling ozone forming compounds (NO_X and VOCs). These include the Low Emission Vehicle Programs, Off-Road Engine Standards, On-Road Heavy-Duty Diesel Vehicles Regulation, and Consumer Products Regulations.

b) Methane

CH_4 is a potent and short-lived GHG. It is the second most prevalent GHG emitted in the United States from human activities. In addition to its climate forcing properties, methane also has a number of indirect effects including its role in contributing to global background ozone. As air quality standards tighten, reducing background ozone becomes more critical.

Enteric fermentation, manure management, landfills, natural gas transmission (methane is a significant constituent of natural gas), and wastewater treatment are the State's largest man-made methane-producing sources.

Methane concentrations have been increasing due to human activities related to fossil fuel extraction and distribution, agriculture, and waste handling. Methane emissions are also contributed by non-anthropogenic or "natural" sources such as wetlands, oceans, forests, fires, terrestrial arthropods (such as termites) and geological sources (such as submarine gas seepage, micro seepage over dry lands and geothermal seeps).

c) Hydrofluorocarbons

HFCs are synthetic gases that are the fastest growing climate forcers in the United States as well as in many other countries. HFCs represent just three percent of all GHG emissions in California, but their warming effect is hundreds to thousands of times that of CO_2. HFCs are primarily produced for use as substitutes for ozone-depleting substances (ODS) in refrigeration, air conditioning, insulating foams, solvents, aerosol products, and fire protection.

d) Black Carbon

Black carbon is a subset of PM emissions and consists of small dark particles that result from incomplete combustion of fossil fuels, bio-fuels, and biomass. It contributes to climate change both directly by absorbing sunlight, and indirectly by depositing on snow and by interacting with clouds and affecting cloud formation.

Unlike other GHGs, black carbon has a very short atmospheric lifetime (an average of about a week), resulting in a strong correlation to regional emission sources. As a result, emission reductions have immediate benefits for climate and health.

The main sources of black carbon in California are wildfires, off-road vehicles (locomotives, marine vessels, tractors, excavators, dozers, etc.), on-road vehicles (cars, trucks, and buses), fireplaces, agricultural burning (burning agricultural waste), and prescribed burning (planned burns of forest or wildlands). California has been an international leader in reducing black carbon, with 90 percent control since the early 1960s and close to 95 percent control expected by 2020 due to existing programs that target reducing PM from diesel engines and burning activities.

Recent ARB estimates suggest that the annual black carbon emissions in California decreased about 70 percent between 1990 and 2010, in direct proportion to declining diesel PM emissions - a co-benefit of ARB's regulations on diesel engines. Other categories of diesel engines, such as off-road diesels (e.g., agricultural and construction equipment), building equipment and diesel generators, are also projected to have major declines in diesel PM emissions. Efforts to manage agricultural, forest, and range land management burning operations are expected to continue reducing black carbon emissions.

5. Adaptation to Climate Change

According to the IPCC, which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, global average temperature is expected to increase by 3–7°F by the end of the century, depending on future GHG emission scenarios (IPCC 2007). Resource areas other than air quality and global average temperature could be indirectly affected by the accumulation of GHG emissions. For example, an increase in the global average temperature is expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada. Snowpack in the Sierra Nevada provides

both water supply (runoff) and storage (within the snowpack before melting), which is a major source of supply for the state (including the project site).

According to the California Energy Commission (CEC 2012), statewide average temperatures increased by about 1.7 degrees Fahrenheit from 1895 to 2011. Throughout the past century precipitation (i.e., rain and snow) has followed the expected pattern of a largely Mediterranean climate with wet winters and dry summers, and considerable variability from year to year. No consistent trend in the overall amount of precipitation has been detected, except that a larger proportion of total precipitation is falling as rain instead of snow. In addition, during the last 35 years, the Sierra Nevada range has witnessed both the wettest and the driest years on record of more than 100 years. While intermittent droughts have been a common feature of the State's climate, evidence from tree rings and other indicators reveal that over the past 1,500 years, California has experienced dry spells that persisted for several years or even decades (CEC 2012).

The effects of global climate change could lead to a variety of secondary effects to public health, water supply, energy supply, sea level, wildfire risks, and ecosystems. Recent data, climate projections, topographic, demographic, and land use information have led to the findings that:

- The state's electricity system is more vulnerable than was previously understood.
- The Sacramento-San Joaquin Delta is sinking, putting levees at growing risk.
- Wind and waves, in addition to faster rising seas, will worsen coastal flooding.
- Animals and plants need connected "migration corridors" to allow them to move to more suitable habitats to avoid serious impacts.
- Native freshwater fish are particularly threatened by climate change.
- Minority and low-income communities face the greatest risks from climate change.
- There are effective ways to prepare for and manage climate change risks, but local governments face many barriers to adapting to climate change; these can be addressed so that California can continue to prosper.

At the same time, the State has recognized the need to adapt to climate change impacts that can no longer be avoided. Currently, the State is developing its second adaptation strategy, acknowledging the steady progress made since the first one in 2009 and recognizing the enormous challenges ahead. The strategy will need to be updated periodically in the future. The many adaptation planning efforts underway in virtually every State agency, in local communities such as Chula Vista, San Diego, Los Angeles, Santa Barbara, Santa Cruz, San Francisco, Hayward, Marin County, and others, as well as in private businesses suggest that CEOs, elected officials, planners, and resource managers understand the reality that California and the world is facing.

In fact, the latest climate science makes clear that State, national and global efforts to mitigate climate change must be accelerated to limit global warming to levels that do not

endanger basic life-support systems and human well-being. Success in mitigation will keep climate change within the bounds that allow ecosystems and society to adapt without major disruptions. Further advances in integrated climate change science can inform California's and the world's climate choices and help ensure a resilient future (CEC 2012).

B. Regulatory Setting

Applicable laws and regulations specific to the reduction of GHG emissions are listed below. It should be noted that other laws and regulations described under Energy Demand in this Environmental Setting would also reduce GHG emissions.

Table 10: Applicable Laws and Regulations for Greenhouse Gases

Regulation	Description
Federal	
Mandatory Greenhouse Gas Reporting Rule	On September 22, 2009, US EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide US EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons or more of CO_2 per year. This publically available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial greenhouse gases along with vehicle and engine manufacturers will report at the corporate level. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.
National Program to Cut Greenhouse Gas Emissions and Improve Fuel Economy for Cars and Trucks	On September 15, 2009, US EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) proposed a new national program that would reduce GHG emissions and improve fuel efficiency for all new cars and trucks sold in the United States. US EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed CAFE standards under the Energy Policy and Conservation Act. This proposed national program would allow automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both Federal programs and the standards of California and other states. The President requested that US EPA and NHTSA, on behalf of the Department of Transportation, develop, through notice and comment rulemaking, a coordinated National Program under the CAA and the Energy Policy and Conservation Act (EPCA), as amended by the Energy Independence and Security Act (EISA), to reduce fuel consumption by and GHG emissions of light-duty vehicles for model years 2017-

Table 10: Applicable Laws and Regulations for Greenhouse Gases	
Regulation	**Description**
	2025. US EPA and NHTSA are developing the proposal based on extensive technical analyses, an examination of the factors required under the respective statutes and on discussions with individual motor vehicle manufacturers and other stakeholders. The National Program would apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles (light-duty vehicles) built in those model years (76 FR 48758). The first part of this program (i.e., 2012-2016) is implemented. The next part (i.e., 2017-2025) is currently in process for which ARB is proposed to accept compliance thereof as also being acceptable for California compliance, similar to what was done for the first part.
Endangerment and Cause or Contribute Findings	On December 7, 2009, US EPA adopted its Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the CAA (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA, which states that the Administrator (of US EPA) should regulate and develop standards for “emission[s] of air pollution from any class of classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.” The rule addresses Section 202(a) in two distinct findings. The first addresses whether or not the concentrations of the six key GHGs (i.e., carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF_6]) in the atmosphere threaten the public health and welfare of current and future generations. The second addresses whether or not the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs and therefore the threat of climate change. The Administrator found that atmospheric concentrations of GHGs endanger the public health and welfare within the meaning of Section 202(a) of the CAA. The evidence supporting this finding consists of human activity resulting in “high atmospheric levels” of GHG emissions, which are very likely responsible for increases in average temperatures and other climatic changes. Furthermore, the observed and projected results of climate change (e.g., higher likelihood of heat waves, wild fires, droughts, sea level rise, higher intensity storms) are a threat to the public health and welfare. Therefore, GHGs were found to endanger the public health and

Table 10: Applicable Laws and Regulations for Greenhouse Gases	
Regulation	**Description**
	welfare of current and future generations. The Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare. US EPA's final findings respond to the 2007 U.S. Supreme Court decision that GHGs fit within the CAA definition of air pollutants. The findings do not in and of themselves impose any emission reduction requirements but rather allow US EPA to finalize the GHG standards proposed earlier in 2009 for new light-duty vehicles as part of the joint rulemaking with the Department of Transportation.
State	
Executive Order S-3-05	Executive Order S-3-05, which was signed by former Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total greenhouse gas emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050. The Executive Order directed the Secretary of the California Environmental Protection Agency (CalEPA) to coordinate a multi-agency effort to reduce greenhouse gas emissions to the target levels. The Secretary will also submit biannual reports to the governor and state legislature describing: progress made toward reaching the emission targets; impacts of global warming on California's resources; and mitigation and adaptation plans to combat these impacts. To comply with the Executive Order, the Secretary of the Cal/EPA created the Climate Action Team (CAT) made up of members from various state agencies and commission. CAT released its first report in March 2006. The report proposed to achieve the targets by building on voluntary actions of California businesses, local government and community actions, as well as through state incentive and regulatory programs.
Assembly Bill 32, the California Global Warming Solutions Act, Statutes of 2006	In September 2006, former Governor Arnold Schwarzenegger signed AB 32, the California Global Warming Solutions Act of 2006. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG

Table 10: Applicable Laws and Regulations for Greenhouse Gases	
Regulation	**Description**
	emissions that will be phased in starting in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from substantial stationary and mobile source categories. Requires ARB to produce a Scoping Plan by 1/1/2009 and at least every five years afterwards that details how the State will meet its GHG reduction targets. AB 32 requires that ARB adopt a quantified cap on GHG emissions representing 1990 emissions levels and disclose how it arrives at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms to ensure that the state achieves the reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.
Assembly Bill 1493, Statutes of 2002	In September 2004, ARB approved regulations to reduce GHG emissions from new motor vehicles. The Board took this action pursuant to Chapter 200, Statutes of 2002 (AB 1493, Pavley) which directed the Board to adopt regulations that achieve the maximum feasible and cost effective reduction in greenhouse gas emissions from motor vehicles. The regulations, which took effect in 2006 following an opportunity for legislative review, apply to new passenger vehicles and light duty trucks beginning with the 2009 model year.
Executive Order S-1-07	Executive Order S-1-07, which was signed by former Governor Schwarzenegger in 2007, proclaims that the transportation sector is the main source of GHG emissions in California, at over 40 percent of statewide emissions. It establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10 percent by 2020. This order also directed ARB to determine if this Low Carbon Fuel Standard (LCFS) could be adopted as a discrete early action measure after meeting the mandates in AB 32. The Board approved the LCFS on April 23, 2009.
Senate Bill 1368, Statutes of 2006	SB 1368 is the companion bill of AB 32 and was signed by former Governor Schwarzenegger in September 2006. SB 1368 requires the CPUC to establish a GHG emission performance standard for baseload generation from investor owned utilities by February 1, 2007. The CEC must establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the greenhouse gas emission rate from a baseload combined-cycle natural gas fired plant. The legislation further requires that all

Table 10: Applicable Laws and Regulations for Greenhouse Gases	
Regulation	**Description**
	electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the CPUC and CEC.
Senate Bill 1078, Statutes of 2002, Senate Bill 107, Statutes of 2006,and SBx1 2	SB 1078 (Chapter 516, Statutes of 2002) requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to provide at least 20 percent of their supply from renewable sources by 2017. SB 107 (Chapter 464, Statutes of 2006) changed the target date to 2010. In 2010, SBx1 2 was chaptered, which expanded the State's Renewable Portfolio Standard to 33 percent renewable power by 2020.
Senate Bill 97, Statutes of 2007	As directed by SB 97, the Natural Resources Agency adopted Amendments to the CEQA Guidelines for greenhouse gas emissions on December 30, 2009. On February 16, 2010, the Office of Administrative Law approved the Amendments, and filed them with the Secretary of State for inclusion in the California Code of Regulations. The Amendments became effective on March 18, 2010.
Senate Bill 375, Statutes of 2008	SB 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's Regional Transportation Plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for funding programmed after January 1, 2012. This bill also extends the minimum time period for the Regional Housing Needs Allocation (RNHA) cycle from 5 years to 8 years for local governments located within an MPO that meets certain requirements. City or County land use policies (including General Plans) are not required to be consistent with the RTP (and associated SCS or APS). However, new provisions of CEQA would incentivize qualified projects that are consistent with an approved SCS or APS, categorized as "transit priority projects."
Executive Order S-13-08	Sea level rise is a foreseeable indirect environmental impact associated with climate change, largely attributable to thermal

Table 10: Applicable Laws and Regulations for Greenhouse Gases	
Regulation	**Description**
	expansion of the oceans and melting polar ice. As discussed above in the environmental setting (subheading “Adaptation to Climate Change”), sea level rise presents impacts to California associated with coastal erosion, water supply, water quality, saline-sensitive species and habitat, land use compatibility, and flooding. Former Governor Arnold Schwarzenegger signed Executive Order S-13-08 on November 14, 2008. This executive order directed the California Natural Resources Agency (CNRA) to develop the 2009 California Climate Adaptation Strategy (CNRA 2009)), which summarizes the best known science on climate change impacts in seven distinct sectors—public health, biodiversity and habitat, ocean and coastal resources, water management, agriculture, forest resources, and transportation and energy infrastructure—and provides recommendations on how to manage against those threats. This executive order also directed OPR, in cooperation with the CNRA, to provide land use planning guidance related to sea level rise and other climate change impacts by May 30, 2009, which is also provided in the 2009 California Climate Adaptation Strategy (CNRA 2009) and OPR continues to further refine land use planning guidance related to climate change impacts. Executive Order S-13-08 also directed CNRA to convene an independent panel to complete the first California Sea Level Rise Assessment Report. This report is to be completed no later than December 1, 2010. The report is intended to provide information on the following: • relative sea level rise projections specific to California, taking into account issues such as coastal erosion rates, tidal impacts, El Niño and La Niña events, storm surge, and land subsidence rates; • the range of uncertainty in selected sea level rise projections; • a synthesis of existing information on projected sea level rise impacts to state infrastructure (such as roads, public facilities and beaches), natural areas, and coastal and marine ecosystems; and • discussion of future research needs regarding sea level rise for California.

8.0 HAZARDS AND HAZARDOUS MATERIALS

A. Existing Conditions

California Health and Safety Code (Section 25501) defines "hazardous materials" as any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Hazardous materials are grouped into four categories based on their characteristics: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials) and reactive (causes explosions or generates toxic gases). A hazardous waste is any hazardous material that is finished with its intended use and is discarded. This may include items, such as spent fuels, industrial solvents and chemicals, process water, and other spent materials (i.e., some types of batteries and fuel cells). California's hazardous waste regulations provides the following means to determine whether or not a waste is hazardous: (1) a list of criteria (toxic, ignitable, corrosive and reactive) that a waste may exhibit; (2) a list of those wastes that are subject to regulation; and (3) a list of chemical names and common names that are presumed to be hazardous in California.

B. Regulatory Setting

Table 11: Applicable Laws and Regulations for Hazards and Hazardous Materials

Regulations	Description
Federal	
CAA (42 USC Section 9601 et seq.)	The CAA is the law that defines US EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The last major change in the law, the CAA Amendments of 1990, was enacted by Congress in 1990. Legislation passed since then has made several minor changes. The CAA like other laws enacted by Congress, was incorporated into the United States Code as Title 42, Chapter 85. The House of Representatives maintains a current version of the U.S. Code, which includes Clean Air Act changes enacted since 1990.
CWA (40CFR 112)	The 1972 amendments to the CWA provide the statutory basis for the NPDES permit program and the basic structure for regulating the discharge of pollutants from point sources to waters of the United States. Section 402 of the CWA specifically required US EPA to develop and implement the NPDES program.
Safe Drinking Water Act (SDWA)	SDWA is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, US EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was

Table 11: Applicable Laws and Regulations for Hazards and Hazardous Materials	
Regulations	**Description**
	amended in 1986 and 1996 and requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and ground water wells. SDWA does not regulate private wells which serve fewer than 25 individuals.
Federal Underground Injection Control Class VI Program for Carbon Dioxide Geology Sequestration Wells	The Federal Underground Injection Control (UIC) Class VI Program for Carbon Dioxide Geologic Sequestration Wells requires states and owners or operators to submit all permit applications to the appropriate EPA Region in order for a Class VI permit to be issued. These requirements, also known as the Class VI rule, are designed to protect underground sources of drinking water. The Class VI rule builds on existing UIC Program requirements, with extensive tailored requirements that address carbon dioxide injection for long-term storage to ensure that wells used for geologic sequestration are appropriately sited, constructed, tested, monitored, funded, and closed. The rule also affords owners or operators injection depth flexibility to address injection in various geologic settings in the United States in which geologic sequestration may occur, including very deep formations and oil and gas fields that are transitioned for use as carbon dioxide storage sites.
Federal Hazardous Materials Regulations (FHMR) Title 49, Code of Federal Regulations, Parts 100-180	The regulations establish criteria for the safe transport of hazardous materials. Compliance is mandatory for intrastate and interstate transportation.
Toxic Substances Control Act (TSCA) 15 U.S.C. Section 2601 et seq.	TSCA provides US EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint.
Resource Conservation and Recovery Act (RCRA) 42 U.S.C. Section 6901 et seq. Title 40, CFR	RCRA of 1976 gives US EPA the authority to control hazardous waste from the “cradle-to-grave.” This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled US EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. HSWA - the Federal Hazardous and Solid Waste Amendments - are the 1984 amendments to RCRA that focused on waste minimization and phasing out land disposal of hazardous waste as well as corrective action for releases. Some of

Table 11: Applicable Laws and Regulations for Hazards and Hazardous Materials	
Regulations	**Description**
	the other mandates of this law include increased enforcement authority for US EPA, more stringent hazardous waste management standards, and a comprehensive underground storage tank program. Federal regulations adopted by US EPA are found in Title 40, Code of Federal Regulations (40 CFR).
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	CERCLA, commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL. The Superfund Amendments and Reauthorization Act (SARA) of 1986 reauthorized CERCLA to continue cleanup activities around the country. Several site-specific amendments, definitions clarifications, and technical requirements were added to the legislation, including additional enforcement authorities. Also, Title III of SARA authorized the Emergency Planning and Community Right-to-Know Act (EPCRA).
Emergency Planning and Community Right-to-Know Act (EPCRA) (42 USC Section 9601 et seq.)	The SARA of 1986 created EPCRA (40 CFR Parts 350-372), also known as SARA Title III, a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by state/tribe and local governments. EPCRA required the establishment of state/tribe emergency response commissions (SERCs/TERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).
State	
Various California Air Pollution Control Laws (i.e., Bluebook)	Includes all relevant Health and Safety Code sections of law, plus those air pollution- related statutes from other California codes, and the CCR Titles 13 & 17 sections that pertain to ARB's air management program.
Hazardous Materials Transportation California Vehicle Code Sections 31301-31309	Regulations pertaining to the safe transport of hazardous materials are in California Vehicle Code Sections 31301-31309. All motor carriers and drivers involved in transportation of hazardous materials must comply with the requirements contained in federal and state regulations, and must apply for and obtain a hazardous materials transportation license from the California Highway Patrol. A driver is required to obtain a hazardous materials endorsement issued by the driver's country or state of domicile to operate any

Table 11: Applicable Laws and Regulations for Hazards and Hazardous Materials	
Regulations	**Description**
	commercial vehicle carrying hazardous materials. The driver is required to display placards or markings while hauling hazardous waste, unless the driver is exempt from the endorsement requirements. A driver who is a California resident is required to obtain an endorsement from California Highway Patrol.
Hazardous Waste Control Law California Health & Safety Code, Division 20, Chapter 6.5 CCR, Division 4.5, Title 22	California requirements and statutory responsibilities in managing hazardous waste in California – this includes the generation, transportation, storage, treatment, recycling, and disposal of hazardous waste. The statute and regulation are implemented by Cal/EPA Department of Toxic Substances Control.
California Accidental Release Prevention (CalARP) Program CCR, Title 19, Division 2, Chapter 4.5, Sections 2735-2785	The purpose of the CalARP program is to prevent accidental releases of substances that can cause serious harm to the public and the environment, to minimize the damage if releases do occur, and to satisfy community right-to-know laws. This is accomplished by requiring businesses that handle more than a threshold quantity of a regulated substance listed in the regulations to develop a Risk Management Plan (RMP). An RMP is a detailed engineering analysis of the potential accident factors present at a business and the mitigation measures that can be implemented to reduce this accident potential.
Hazardous Material Business Plan & Area Plan Program Health and Safety Code Sections 25500 – 25520 CCR, Title 19, Division 2, Chapter 4, Article 3 & 4	The business and area plans program, relating to the handling and release or threatened release of hazardous materials, was established in California to protect the public health and safety and the environment. Basic information on the location, type, quantity, and the health risks of hazardous materials handled, used, stored, or disposed of in the State, which could be accidently released into the environment, is not now available to firefighters, health officials, planners, public safety officers, health care providers, regulatory agencies, and other interested persons. The information provided by business and area plans is necessary in order to prevent or mitigate the damage to the health and safety of persons and the environment from the release or threatened release of hazardous materials into the workplace and environment. Certified Unified Program Agencies (CUPAs) use information collected from the Business Plan and CalARP programs to identify hazardous materials in their communities. This information provides the basis for the Area Plan and is used to determine the appropriate level of emergency planning necessary to respond to a release.

Table 11: Applicable Laws and Regulations for Hazards and Hazardous Materials	
Regulations	**Description**
Unified Program Administration Health and Safety Code, Chapter 6.11, Sections 25404-25404.8 CCR, Title 27, Division 1, Subdivision 4, Chapter 1, Sections 15100-15620	A CUPA, which is authorized by the Secretary of Cal/EPA to carry out several of the hazardous waste/hazardous materials regulatory programs administered by the State in a coordinated and consistent manner. The 6 hazardous waste and materials program elements covered by the CUPA include: 1) Hazardous Waste Generators 2) Underground Tanks 3) Above Ground Tanks 4) Accidental Release Program 5) Hazardous Material Release Response Plans & Spill Notification 6) Hazardous Materials Management Plans & Inventory Reporting The intent of the CUPA is to simplify the hazardous materials regulatory environment and provide a single point of contact for businesses to address inspection, permitting, billing, and enforcement issues.
Various Local Ordinances	Various ordinances and codes may be adopted at the local level to provide stricter requirements in the management of hazardous materials and waste activities within the jurisdiction.

9.0 HYDROLOGY AND WATER QUALITY

A. Existing Conditions

1. Surface Waters

Surface waters occur as streams, lakes, ponds, coastal waters, lagoons, estuaries, floodplains, dry lakes, desert washes, wetlands and other collection sites. Water bodies modified or developed by man, including reservoirs and aqueducts, are also considered surface waters. Surface water resources are very diverse throughout the state, due to the high variance in tectonics, topography, geology/soils, climate, precipitation, and hydrologic conditions. Overall, California has the most diverse range of watershed conditions in the U.S., with varied climatic regimes ranging from Mediterranean climates with temperate rainforests in the north coast region to desert climates containing dry desert washes and dry lakes in the southern central region.

The average annual runoff for the State is 71 million acre-feet (DWR 1998). The State has more than sixty major stream drainages and more than 1,000 smaller, but significant drainages that drain coastal mountains and inland mountainous areas. High snowpack levels and resultant spring snowmelt yield high surface runoff and peak discharge in the Sierra Nevada and Cascade Mountains that feed surface flows, fill reservoirs and recharge groundwater. Federal, state and local engineered water projects, aqueducts, canals, and reservoirs serve as the primary conduits of surface

water sources to areas that have limited surface water resources. Most of the surface water storage is transported for agricultural, urban, and rural residential needs to the San Francisco Bay Area and to cities and areas extending to southern coastal California. Surface water is also transported to southern inland areas, including Owens Valley, Imperial Valley, and Central Valley areas.

2. Groundwater

The majority of runoff from snowmelt and rainfall flows down mountain streams into low gradient valleys and either percolates into the ground or is discharged to the sea. This percolating flow is stored in alluvial groundwater basins that cover approximately 40 percent of the geographic extent of the State (DWR 2003). Groundwater recharge occurs more readily in areas underlain by coarse sediments, primarily in mountain base alluvial fan settings. As a result, the majority of California's groundwater basins are located in broad alluvial valleys flanking mountain ranges, such as the Cascade Range, Coast Ranges, Transverse Ranges, and the Sierra Nevada.

There are 250 major groundwater basins that serve approximately 30 percent of California's urban, agricultural and industrial water needs, especially in southern portion of San Francisco Bay, the Central Valley, greater Los Angeles area, and inland desert areas where surface water is limited. On average, more than 15 million acre-feet of groundwater are extracted each year in the State, of which more than 50 percent is extracted from 36 groundwater basins in the Central Valley.

3. Water Quality

Land uses have a great effect on surface water and groundwater water quality in the State of California. Water quality degradation of surface waters occurs through nonpoint- and point- source discharges of pollutants. Nonpoint source pollution is defined as not having a discrete or discernible source and is generated from land runoff, precipitation, atmospheric deposition, seepage, and hydrologic modification (EPA 1993). Nonpoint-source pollution includes runoff containing pesticides, insecticides, and herbicides from agricultural areas and residential areas; acid drainage from inactive mines; bacteria and nutrients from septic systems and livestock; VOCs and toxic chemicals from urban runoff and industrial discharges; sediment from timber harvesting, poor road construction, improperly managed construction sites, and agricultural areas; and atmospheric deposition and hydromodification. In comparison, point-source pollution is generated from identifiable, confined, and discrete sources, such as a smokestack, sewer, pipe or culvert, or ditch. These pollutant sources are regulated by the US EPA and SWRCB through RWQCB. Many of the pollutants discharged from point-sources are the same as for nonpoint-sources, including municipal (bacteria and nutrients), agricultural (pesticides, herbicides, and insecticides), and industrial pollutants (VOCs and other toxic effluent).

B. Regulatory Setting

Table 12: Applicable Laws and Regulations for Hydrology, Water Quality, and Water Supply	
Regulation	**Description**
Federal	
National Flood Insurance Program (FEMA)	Designated floodplain mapping program, flooding and flood hazard reduction implementation, and federal subsidized flood insurance for residential and commercial property. Administered by the FEMA.
Executive Order 11988	Requires actions to be taken for federal activities to reduce the risks of flood losses, restore and preserve floodplains, and minimize flooding impacts to human health and safety.
CWA	Administered primarily by the U.S. Environmental Protection Agency (US EPA). Pertains to water quality standards, state responsibilities, and discharges of waste to waters of the United States. Sections 303, 401, 402, and 404.
CWA Section 303	Defines water quality standards consisting of: 1) designated beneficial uses of a water, 2) the water quality criteria (or "objectives" in California) necessary to support the uses, and 3) an antidegradation policy that protects existing uses and high water quality. Section 303(d) requires states to identify water quality impairments where conventional control methods will not achieve compliance with the standards, and establish Total Maximum Daily Load (TMDL) programs to achieve compliance.
CWA Section 401	State certification system for federal actions which may impose conditions on a project to ensure compliance with water quality standards.
CWA Section 402	Section 402 mandates permits for municipal stormwater discharges, which are regulated under the NPDES General Permit for Municipal Separate Storm Sewer Systems (MS4) (MS4 Permit). Several of the cities and counties issue their own NPDES municipal stormwater permits for the regulations of stormwater discharges. These permits require that controls are implemented to reduce the discharge of pollutants in stormwater discharges to the maximum extent possible, including management practices, control techniques, system design and engineering methods, and other measures as appropriate. As part of permit compliance, these permit holders have created Stormwater Management Plans for their respective locations. These plans outline the requirements for municipal operations, industrial and commercial businesses, construction sites, and planning and land development. These requirements may include multiple measures to control pollutants in stormwater discharge. During implementation of specific projects, applicants

Table 12: Applicable Laws and Regulations for Hydrology, Water Quality, and Water Supply	
Regulation	**Description**
	will be required to follow the guidance contained in the Stormwater Management Plans as defined by the permit holder in that location.
CWA Section 404	Permit system for dredging or filling activity in waters of the U.S., including wetlands, and administered by the U.S. Army Corps of Engineers.
National Toxics Rule and California Toxics Rule	Applicable receiving water quality criteria promulgated by US EPA for priority toxic pollutants consisting generally of trace metals, synthetic organic compounds, and pesticides.
State	
California Water Rights	The State Water Resources Control Board (SWRCB) administers review, assessment, and approval of appropriative (or priority) surface water rights permits/licenses for diversion and storage for beneficial use. Riparian water rights apply to the land and allow diversion of natural flows for beneficial uses without a permit, but users must share the resources equitably during drought. Groundwater management planning is a function of local government. Groundwater use by overlying property owners is not formally regulated, except in cases where the groundwater basin supplies are limited and uses have been adjudicated, or through appropriative procedures for groundwater transfers.
Public Trust Doctrine	Body of common law that requires the State to consider additional terms and conditions when issuing or reconsidering appropriative water rights to balance the use of the water for many beneficial uses irrespective of the water rights that have been established. Public trust resources have traditionally included navigation, commerce, and fishing and have expanded over the years to include protection of fish and wildlife, and preservation goals for scientific study, scenic qualities, and open-space uses.
Porter-Cologne Water Quality Control Act and California Water Code (Title 23)	The SWRCB is responsible for statewide water quality policy development and exercises the powers delegated to the State by the federal government under the CWA. Nine RWQCBs adopt and implement water quality control plans (Basin Plans) which designate beneficial uses of surface waters and groundwater aquifers, and establish numeric and narrative water quality objectives for beneficial use protection. Regional Water Boards issue waste discharge requirements for discharge activities to water and land, require monitoring and maintain reporting programs, and implement enforcement and compliance policies and procedures. Other state agencies with jurisdiction in water

Table 12: Applicable Laws and Regulations for Hydrology, Water Quality, and Water Supply	
Regulation	**Description**
	quality regulation in California include the Department of Public Health (drinking water regulations), Department of Pesticide Regulation, Department of Toxic Substances Control, CDFW, and the Office of Environmental Health and Hazard Assessment.
Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California	Commonly referred to as the State Implementation Policy (or SIP), the SIP provides implementation procedures for discharges of toxic pollutants to receiving waters.
Thermal Plan	The Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Water and Enclosed Bays and Estuaries of California was adopted by the SWRCB in 1972 and amended in 1975. The Thermal Plan restricts discharges of thermal waste or elevated temperature waste to waters of the state. Generally, the Thermal Plan prohibits discharges from increasing ambient temperatures by more than 1ºF over more than 25 percent of a stream cross section, increasing ambient temperatures by more than 4ºF in any location, and prohibits discharge of waste that exceeds more than 20ºF above the ambient temperature.
Statewide NPDES General Permit for Stormwater Associated with Land Disturbance and Construction Activity (Order No. 2009-0009-DWQ, NPDES No. CAR000002)	NPDES permit for stormwater and non-storm discharges from construction activity that disturbs greater than one acre. The general construction permit requires the preparation of a SWPPP that identifies BMPs to be implemented to control pollution of storm water runoff. The permit specifies minimum construction BMPs based on a risk-level determination of the potential of the project site to contribute to erosion and sediment transport and sensitivity of receiving waters to sediment. While small amounts of construction-related dewatering are covered under the General Construction Permit, the RWQCB has also adopted a General Order for Dewatering and Other Low Threat Discharges to Surface Waters (General Dewatering Permit). This permit applies to various categories of dewatering activities and may apply to some construction sites, if construction of specific projects required dewatering in greater quantities than that allowed by the General Construction Permit and discharged the effluent to surface waters. The General Dewatering Permit contains waste discharge limitations and prohibitions similar to those in the General Construction Permit.

Table 12: Applicable Laws and Regulations for Hydrology, Water Quality, and Water Supply	
Regulation	**Description**
Statewide NPDES General Permit for Discharges of Stormwater Associated with Industrial Facilities (Order No. 97-003-DWQ, NPDES No. CAS000001)	NPDES permit for stormwater and non-storm discharges from types of industrial sites based on the Standard Industrial Classification. The general industrial permit requires the preparation of a SWPPP that identifies potential onsite pollutants, BMPs to be implemented, and inspection/monitoring.
Local	
Water Agencies	Water agencies enter into contracts or agreements with the federal and state governments to protect the water supply and to ensure the lands within the agency have a dependable supply of suitable quality water to meet present and future needs.
Floodplain Management	General Plans guide County land use decisions, and require the identification of water resource protection goals, objectives, and policies. Floodplain management is addressed through ordinances, land use planning, and development design review and approval. Local actions may be coordinated with FEMA for the National Flood Insurance Program. Typical provisions address floodplain use restrictions, flood protection requirement, allowable alteration of floodplains and stream channels, control of fill and grading activities in floodplains, and prevention of flood diversions where flows would increase flood hazards in other areas.
Drainage, Grading, and Erosion Control Ordinances	Counties regulate building activity under the federal Uniform Building Code, local ordinances, and related development design review, approval, and permitting. Local ordinances are common for water quality protection addressing drainage, stormwater management, land grading, and erosion and sedimentation control.
Environmental Health	The RWQCBs generally delegate permit authority to County health departments to regulate the construction and operation/maintenance of on-site sewage disposal systems (e.g., septic systems and leach fields, cesspools).

10.0 LAND USE AND PLANNING

A. Existing Conditions

In California, the State Planning and Zoning Law (California Government Code section 65000 et seq.) provides the primary legal framework that cities and counties must follow in land use planning and controls. Planned land uses are designated in the city or county General Plan, which serves as the comprehensive master plan for the community. Also, city and county land use and other related resource policies are defined in the General Plan. The primary land use regulatory tool provided by the California Planning and Zoning Law is the zoning ordinance adopted by each city and county. Planning and Zoning Law requirements are discussed in the regulatory setting below.

When approving land use development, cities and counties must comply with CEQA, which requires that they consider the significant environmental impacts of their actions and the adoption of all feasible mitigation measures to substantially reduce significant impacts, in the event a project causes significant or potentially significant effects on the environment. In some cases, building permits may be ministerial, and therefore exempt from CEQA, but most land use development approval actions by cities and counties require CEQA compliance.

B. Regulatory Setting

Table 13: Applicable Laws and Regulations for Land Use and Planning

Regulation	Description
Federal	
FLPMA	FLPMA is the principal law governing how the BLM manages public lands. FLPMA requires the BLM to manage public land resources for multiple use and sustained yield for both present and future generations. Under FLPMA, the BLM is authorized to grant right-of-ways for generation, transmission, and distribution of electrical energy. Although local agencies do not have jurisdiction over the federal lands managed by the BLM, under FLPMA and the BLM regulations at 43 CFR Part 1600, the BLM must coordinate its planning efforts with state and local planning initiatives. FLPMA defines an Area of Critical Environmental Concern (ACEC) as an area within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. The BLM identifies, evaluates, and designates ACECs through its resource management planning process. Allowable management practices and uses, mitigation, and use limitations, if any, are described in the planning document and

Table 13: Applicable Laws and Regulations for Land Use and Planning	
Regulation	**Description**
	the concurrent or subsequent ACEC Management Plan. ACECs are considered land use authorization avoidance areas because they are known to contain resource values that could result in denial of applications for land uses that cannot be designed to be compatible with management objectives and prescriptions for the ACEC.
BLM Resource Management Plans	Established by FLPMA, Resource Management Plans are designed to protect present and future land uses and to identify management practices needed to achieve desired conditions within the management area covered by the Resource Management Plans. Management direction is set forth in the Resource Management Plans in the form of goals, objectives, standards, and guidelines. These, in turn, direct management actions, activities, and uses that affect land management, and water, recreation, visual, natural, and cultural resources.
State	
State Planning and Zoning Law	California Government Code section 65300 et seq. establishes the obligation of cities and counties to adopt and implement general plans. The general plan is a comprehensive, long-term, and general document that describes plans for the physical development of the city or county. The general plan addresses a broad range of topics, including, at a minimum, land use, circulation, housing, conservation, open space, noise, and safety. In addressing these topics, the general plan identifies the goals, objectives, policies, principles, standards, and plan proposals that support the city or county's vision for the area. The general plan is also a long-range document that typically addresses the physical character of an area over a 20-year period. Although the general plan serves as a blueprint for future development and identifies the overall vision for the planning area, it remains general enough to allow for flexibility in the approach taken to achieve the plan's goals.
Subdivision Map Act (Government Code section 66410 et seq.)	In general, land cannot be divided in California without local government approval. The primary goals of the Subdivision Map Act are: (a) to encourage orderly community development by providing for the regulation and control of the design and improvements of the subdivision with a proper consideration of its relation to adjoining areas; (b) to ensure that the areas within the subdivision that are dedicated for public purposes will be properly improved by the subdivider so that they will not become an undue burden on the community; and (c) to protect the public and individual transferees from fraud and exploitation. (61 Ops. Cal.Atty. Gen. 299, 301 [1978]; 77 Ops. Cal.Atty. Gen. 185 [1994]). Dividing land for sale, lease or financing is regulated by local ordinances based on the state Subdivision Map Act (Government Code section 66410 et seq.).

Table 13: Applicable Laws and Regulations for Land Use and Planning	
Regulation	**Description**
Local	
General Plans	The most comprehensive land use planning is provided by city and county general plans, which local governments are required by State law to prepare as a guide for future development. The general plan contains goals and policies concerning topics that are mandated by State law or which the jurisdiction has chosen to include. Required topics are: land use, circulation, housing, conservation, open space, noise, and safety. Other topics that local governments frequently choose to address are public facilities, parks and recreation, community design, or growth management, among others. City and county general plans must be consistent with each other. County general plans must cover areas not included by city general plans (i.e., unincorporated areas).
Specific and Community Plans	A city or county may also provide land use planning by developing community or specific plans for smaller, more specific areas within their jurisdiction. These more localized plans provide for focused guidance for developing a specific area, with development standards tailored to the area, as well as systematic implementation of the general plan. Specific and community plans are required to be consistent with the city or county's general plan.
Zoning	The city or county zoning code is the set of detailed requirements that implement the general plan policies at the level of the individual parcel. The zoning code presents standards for different uses and identifies which uses are allowed in the various zoning districts of the jurisdiction. Since 1971, State law has required the city or county zoning code to be consistent with the jurisdiction's general plan, except in charter cities.
Housing Element Law	State law requires each city and county to adopt a general plan containing at least seven mandatory elements including housing. Unlike the other general plan elements, the housing element, required to be updated every five to six years, is subject to detailed statutory requirements and mandatory review by a State agency, the California Department of Housing and Community Development (Department). Housing elements have been mandatory portions of local general plans since 1969. This reflects the statutory recognition that housing is a matter of statewide importance and cooperation between government and the private sector is critical to attainment of the State's housing goals. The availability of an adequate supply of housing affordable to workers, families, and seniors is critical to the State's long-term economic competitiveness and the quality of life for all Californians.

11.0 MINERAL RESOURCES

A. Existing Conditions

The CGS classifies the regional significance of mineral resources in accordance with the California Surface Mining and Reclamation Act of 1975 and assists the CGS in the designation of land containing significant aggregate resources. Mineral Resources Zones (MRZs) have been designated to indicate the significance of mineral deposits. The MRZ categories follow:

MRZ-1: Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence.

MRZ-2: Areas where adequate information indicates significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence.

MRZ-3: Areas containing mineral deposits the significance of which cannot be evaluated from available data.

MRZ-4: Areas where available information is inadequate for assignment to any other MRZ.

California ranks as the 7th state in the U.S. for non-fuel mineral production, accounting for approximately 3.9 percent of the nation's total. In 2011, there were approximately 700 active mineral mines that produced: sand and gravel, boron, Portland cement, crushed stone, gold, masonry cement, clays, gemstones, gypsum, salt, silver, and other minerals (Clinkenbeard and Smith 2013).

B. Regulatory Setting

Table 14: Applicable Laws and Regulations for Mineral Resources

Regulation	Description
Federal	
Mining and Mineral Policy Act	The Mining and Mineral Act of 1970 declared that the Federal Government policy is to encourage private enterprise in the development of a sound and stable domestic mineral industry, domestic mineral deposits, minerals research, and methods for reclamation in the minerals industry.
State	
Surface Mining and Reclamation Act (SMARA)	The intent of SMARA of 1975 is to promote production and conservation of mineral resources, minimize environmental effects of mining, and to assure that mined lands will be reclaimed to conditions suitable for alternative uses. An important part of the SMARA legislation requires the State Geologist to classify land according to the presence or absence of significant mineral

Table 14: Applicable Laws and Regulations for Mineral Resources	
Regulation	**Description**
	deposits. Local jurisdictions are given the authority to permit or restrict mining operations, adhering to the SMARA legislation. Classification of an area using Mineral Resource Zones (MRZ) to designate lands that contain mineral deposits are designed to protect mineral deposits from encroaching urbanization and land uses that are incompatible with mining. The MRZ classifications reflect varying degrees of mineral significance, determined by available knowledge of the presence or absence of mineral deposits as well as the economic potential of the deposits.
CBSC (CCR Title 24)	California's minimum standards for structural design and construction are given in the CBSC (CCR Title 24). The CBSC is based on the Uniform Building Code (International Code Council 1997), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, proponents of specific projects would be required to comply with all provisions of the CBSC for certain aspects of design and construction.
Local	
Local Grading and Erosion Control Ordinances	Many counties and cities have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit is typically required for construction-related projects. As part of the permit, project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP.
County General Plans (and EIR)	Some county General Plans provide a regulatory framework to address potential environmental impacts that may result from a proposed project

12.0 NOISE

A. Existing Conditions

Acoustics is the scientific study that evaluates perception, propagation, absorption, and reflection of sound waves. Sound is a mechanical form of radiant energy, transmitted by a pressure wave through a solid, liquid, or gaseous medium. Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise. Common sources of environmental noise and noise levels are presented in Table 15.

Table 15: Typical Noise Levels

Common Outdoor Activities	Noise Level (dB)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet	100	--
Gas lawnmower at 3 feet	90	--
Diesel truck moving at 50 mph at 50 feet	80	Food blender at 3 feet, Garbage disposal at 3 feet
Noisy urban area, Gas lawnmower at 100 feet	70	Vacuum cleaner at 10 feet, Normal speech at 3 feet
Commercial area, Heavy traffic at 300 feet	60	
Quiet urban daytime	50	Large business office, Dishwasher in next room
Quiet urban nighttime	40	Theater, Large conference room (background)
Quiet suburban nighttime	30	Library, Bedroom at night, Concert hall (background)
Quiet rural nighttime	20	Broadcast/Recording Studio
	10	--
Threshold of Human Hearing	0	Threshold of Human Hearing

Notes: dB=A-weighted decibels; mph=miles per hour
Source: Caltrans 2009: p.2-21

1. Sound Properties

A sound wave is initiated in a medium by a vibrating object (e.g., vocal chords, the string of a guitar, the diaphragm of a radio speaker). The wave consists of minute variations in pressure, oscillating above and below the ambient atmospheric pressure. The number of pressure variation cycles occurring per second is referred to as the frequency of the sound wave and is expressed in hertz.

Directly measuring sound pressure fluctuations would require the use of a very large and cumbersome range of numbers. To avoid this and have a more useable numbering

system, the decibel (dB) scale was introduced. A sound level expressed in decibels is the logarithmic ratio of two like pressure quantities, with one pressure quantity being a reference sound pressure. For sound pressure in air the standard reference quantity is generally considered to be 20 micropascals, which directly corresponds to the threshold of human hearing. The use of the decibel is a convenient way to handle the million-fold range of sound pressures to which the human ear is sensitive. A decibel is logarithmic; it does not follow normal algebraic methods and cannot be directly summed. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound level increase of 10 dB corresponds to 10 times the acoustical energy, and an increase of 20 dB equates to a 100 fold increase in acoustical energy.

The loudness of sound perceived by the human ear depends primarily on the overall sound pressure level and frequency content of the sound source. The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed. The standard weighting networks are identified as A through E. There is a strong correlation between the way humans perceive sound and A-weighted sound levels (dBA). For this reason the dBA can be used to predict community response to noise from the environment, including noise from transportation and stationary sources. Sound levels expressed as dB in this section are A-weighted sound levels, unless noted otherwise.

Noise can be generated by a number of sources, including mobile sources (i.e., transportation) such as automobiles, trucks, and airplanes and stationary sources (i.e., non-transportation) such as construction sites, machinery, and commercial and industrial operations. As acoustic energy spreads through the atmosphere from the source to the receiver, noise levels attenuate (i.e., decrease) depending on ground absorption characteristics, atmospheric conditions, and the presence of physical barriers. Noise generated from mobile sources generally attenuate at a rate of 4.5 dB per doubling of distance. Stationary noise sources spread with more spherical dispersion patterns that attenuate at a rate of 6 to 7.5 dB per doubling of distance.

Atmospheric conditions such as wind speed, turbulence, temperature gradients, and humidity may additionally alter the propagation of noise and affect levels at a receiver. Furthermore, the presence of a large object (e.g., barrier, topographic features, and intervening building façades) between the source and the receptor can provide significant attenuation of noise levels at the receiver. The amount of noise level reduction (i.e., shielding) provided by a barrier primarily depends on the size of the barrier, the location of the barrier in relation to the source and receivers, and the frequency spectra of the noise. Natural (e.g., berms, hills, and dense vegetation) and human-made features (e.g., buildings and walls) may be used as noise barriers.

All buildings provide some exterior-to-interior noise reduction. A building constructed with a wood frame and a stucco or wood sheathing exterior typically provides a

minimum exterior-to-interior noise reduction of 25 dB with its windows closed, whereas a building constructed of a steel or concrete frame, a curtain wall or masonry exterior wall, and fixed plate glass windows of one-quarter-inch thickness typically provides an exterior-to-interior noise reduction of 30–40 dB with its windows closed (Paul S. Veneklasen & Associates 1973, cited in Caltrans 2002: p. 7-37).

2. Common Noise Descriptors

The intensity of environmental noise fluctuates over time, and several different descriptors of time-averaged noise levels are used. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the environment. The noise descriptors most often in relation to the environment are defined below (Caltrans 2009).

Equivalent Noise Level (L_{eq}): The equivalent steady-state noise level in a stated period of time that would contain the same acoustic energy as the time-varying noise level during the same period (i.e., average noise level).

Maximum Noise Level (L_{max}): The highest instantaneous noise level during a specified time period.

Minimum Noise Level (L_{min}): The lowest instantaneous noise level during a specified time period.

Day-Night Noise Level (L_{dn}): The 24-hour L_{eq} with a 10-dB penalty applied during the noise-sensitive hours from 10 p.m. to 7 a.m., which are typically reserved for sleeping.

Community Noise Equivalent Level (CNEL): Similar to the L_{dn} described above with an additional 5-dB penalty applied during the noise-sensitive hours from 7 p.m. to 10 p.m., which are typically reserved for relaxation, conversation, reading, and watching television.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the L_{eq} descriptor listed above, which corresponds to a steady-state A-weighted sound level containing the same total energy as a time-varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptors such as L_{dn} and CNEL, as defined above, and shows very good correlation with community response to noise.

3. Effects of Noise on Humans

Excessive and chronic exposure to elevated noise levels can result in auditory and non-auditory effects on humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavioral and physiological effects. The non-auditory behavioral effects of noise on humans are associated

primarily with the subjective effects of annoyance, nuisance, and dissatisfaction, which lead to interference with activities such as communications, sleep, and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research infers that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise environments is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment an individual has become accustom to, the less tolerable the new noise source will be perceived.

With respect to how humans perceive and react to changes in noise levels, a 1 dB increase is imperceptible, a 3 dB increase is barely perceptible, a 6 dB increase is clearly noticeable, and a 10 dB increase is subjectively perceived as approximately twice as loud (Egan 2007: p. 21). These subjective reactions to changes in noise levels was developed on the basis of test subjects' reactions to changes in the levels of steady-state pure tones or broad-band noise and to changes in levels of a given noise source. It is probably most applicable to noise levels in the range of 50 to 70 dB, as this is the usual range of voice and interior noise levels. For these reasons, a noise level increase of 3 dB or more is typically considered substantial in terms of the degradation of the existing noise environment.

Negative effects of noise exposure include physical damage to the human auditory system, interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. Gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 2009).

4. Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery or transient in nature, explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (FTA 2006, Caltrans 2004). PPV and RMS vibration velocity are normally described in inches per second (in/sec).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2006). This is based on a reference value of 1micro (μ) inch/second.

The typical background vibration-velocity level in residential areas is approximately 50 VdB. Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2006).

Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities could generate groundborne vibrations that potentially pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2006).

Construction vibrations can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 16 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 16: Human Response to Different Levels of Groundborne Noise and Vibration	
Vibration-Velocity Level	**Human Reaction**
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.
Notes: VdB = vibration decibels referenced to 1 μ inch/second and based on the root mean square (RMS) velocity amplitude. Source: FTA 2006: p. 7-8	

5. Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, schools, historic sites, cemeteries, and recreation areas are also generally considered sensitive to increases in exterior noise levels. Places of worship and transit lodging, and other places where low interior noise levels are essential are also considered noise-sensitive. These types of receptors are also considered vibration-sensitive land uses in addition to commercial and industrial buildings where vibration would interfere with operations within the building, including levels that may be well below those associated with human annoyance.

B. Regulatory Setting

Table 17: Applicable Laws and Regulations for Noise	
Regulation	**Description**
Federal	
Federal Noise Control Act (1972) US EPA, 40 CFR 201-211	This act established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. US EPA was given the responsibility for providing information to the public regarding identifiable effects of noise on public health or welfare, publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety, coordinating federal research and activities related to noise control, and establishing federal noise emission standards for selected products distributed in interstate

Table 17: Applicable Laws and Regulations for Noise	
Regulation	**Description**
	commerce. This act also directed that all federal agencies comply with applicable federal, state, interstate, and local noise control regulations.
Quiet Communities Act (1978)	This act promotes the development of effective State and local noise control programs, to provide funds for noise research, and to produce and disseminate educational materials to the public on the harmful effects of noise and ways to effectively control it.
24 CFR, Part 51B (U.S. Department of Housing and Urban Development [HUD])	This regulation established standards for HUD-assisted projects and actions, requirements, and guidelines on noise abatement and control.
Federal Aviation Administration (FAA) Order 1050.1D	This order contains policies and procedures for considering environmental impacts.
14 CFR, Part 150 (FAA)	These address airport noise compatibility planning and include a system for measuring airport noise impacts and present guidelines for identifying incompatible land uses. All land uses are considered compatible with noise levels of less than 65 dBA L_{dn}. At higher noise levels, selected land uses are also deemed acceptable, depending on the nature of the use and the degree of structural noise attenuation provided.
International Standards and Recommended Practices (International Civil Aviation Organization)	This contains policies and procedures for considering environmental impacts (e.g., aircraft noise emission standards and atmospheric sound attenuation factors).
32 CFR, Part 256 (Department of Defense Air Installations Compatible Use Zones [AICUZ] Program)	AICUZ plans prepared for individual airfields are primarily intended as recommendations to local communities regarding the importance of maintaining land uses which are compatible with the noise and safety impacts of military aircraft operations.
23 CFR, Part 772, Federal Highway Administration (FHWA) standards, policies, and procedures	FHWA standards, policies, and procedures provide procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways.
29 CFR, Part 1910, Section 1910.95	This regulation established a standard for noise exposure in the workplace.

Table 17: Applicable Laws and Regulations for Noise	
Regulation	**Description**
(U.S. Department of Labor Occupational Safety and Health Administration [OSHA])	
FTA Guidance	This guidance presents procedures for predicting and assessing noise and vibration impacts of proposed mass transit projects. All types of bus and rail projects are covered. Procedures for assessing noise and vibration impacts are provided for different stages of project development, from early planning before mode and alignment have been selected through preliminary engineering and final design. Both for noise and vibration, there are three levels of analysis described. The framework acts as a screening process, reserving detailed analysis for projects with the greatest potential for impacts while allowing a simpler process for projects with little or no effects. This guidance contains noise and vibration impact criteria that are used to assess the magnitude of predicted impacts. A range of mitigation is described for dealing with adverse noise and vibration impacts.
49 CFR 210 (Federal Rail Administration [FRA] Railroad Noise Emission Compliance Standards) and FRA Guidance (2005)	This section and guidance provides contains criteria and procedures for use in analyzing the potential noise and vibration impacts of various types of high-speed fixed guideway transportation systems.
State	
CPUC Section 21670	The State Aeronautics Act of the CPUC establishes statewide requirements for airport land use compatibility planning and requires nearly every county to create an Airport Land Use Commission or other alternative.
Section 5000 et seq. (CCR, Title 21, Division 2.5, Chapter 6), California Airport Noise Regulations promulgated in accordance with the State Aeronautics Act	In Section 5006, the regulations state that: “The level of noise acceptable to a reasonable person residing in the vicinity of an airport is established as a CNEL value of 65 dBA for purposes of these regulations. This criterion level has been chosen for reasonable persons residing in urban residential areas where houses are of typical California construction and may have windows partially open. It has been selected with reference to speech, sleep and community reaction.
California Streets and Highways Code Section 216 (Freeway Noise in Classrooms)	This section, known as the Control of Freeway Noise in School Classrooms, requires that, in general, Caltrans abate noise from freeways to specified levels when the noise exceeds specified levels in school classrooms

Table 17: Applicable Laws and Regulations for Noise	
Regulation	**Description**
California Government Code Section 65302 (Provision of Noise Contour Maps)	This section requires Caltrans to provide cities and counties with noise contour maps along State highways.
Title 24, Part 2, California Code of Regulations	These establish standards governing interior noise levels that apply to all new single-family and multi-family residential units in California. These standards require that acoustical studies be performed before construction at building locations where the existing L_{dn} exceeds 60 dBA. Such acoustical studies are required to establish mitigation that will limit maximum Ldn levels to 45 dBA in any habitable room.

13.0 EMPLOYMENT, POPULATION, AND HOUSING

A. Existing Conditions

1. Population

Population trends and growth projections are useful measures to help predict and plan for future State recreational facility needs. According to the California Department of Finance 2010 Census data, the population of California in 2010 was approximately 37,253,956 (DOF 2010). Since California became a state in 1850, the population has been increasing rapidly. Within the first 150 years of California's statehood, the population increased from fewer than 100,000 citizens to almost 34 million in 2000 (CSP 2005). It is expected that the population of California will reach and surpass the 50-million mark sometime between 2030 and 2040 if the current growth rates persist (CSP 2005).

2. Housing

As population within the State increases, housing distribution and household conditions are expected to evolve. Existing housing units, households, and vacancy rates for the State of California are shown below in Table 18. Data was derived from the California Department of Finance 2010 Census (DOF 2010).

Table 18: California Housing Profile	
Total Housing Units	13,680,081
Total households	12,577,498
Vacant housing units	1,102,583
Owner-occupied	7,035,371
Renter-occupied	15,691,211
Homeowner vacancy rate	2.1
Rental vacancy rate	6.3
Source: DOF 2010	

B. Regulatory Setting

Federal and state laws do not control population and employment. See housing-related regulations in Section J, Land Use and Planning.

14.0 PUBLIC SERVICES

A. Existing Conditions

1. Law Enforcement

US EPA is charged with protecting human health and the environment, by writing and enforcing regulations based on laws passed by Congress. The Environmental Protection Agency's Criminal Investigation Division primary mission is the enforcement of the United States' environmental laws as well as any other federal law in accordance with the guidelines established by the Attorney General of the United States (18 U.S.C. 3063). These environmental laws include those specifically related to air, water and land resources.

Enforcement of environmental laws in California is the responsibility of the Attorney General's Office and the CalEPA. The Attorney General represents the people of California in civil and criminal matters before trial courts, appellate courts and the supreme courts of California and the United States. In regards to environmental issues, the Attorney General enforces laws that safeguard the environment and natural resources in the State. Recent actions by the Attorney General related to air quality and climate change issues include: legally defending the State's clean cars law against multiple challenges, filing numerous actions against the Bush Administration regarding regulation of global warming pollution, working with local governments to ensure that land use planning processes take account of global warming, promoting renewable energy and enhanced energy efficiency in California, and working with other State leaders and agencies to implement AB 32, the Global Warming Solutions Act of 2006 (DOJ 2011).

CalEPA was created in 1991 by Governor's Executive Order. CalEPA's mission is to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality. The CalEPA is comprised of various boards, departments and offices, including: ARB, Department of Pesticide Regulation, Department of Toxic Substances Control, Office of Environmental Health Hazard Assessment, and State Water Resources Control Board (including the nine Regional Water Quality Control Boards).

California's environmental laws are enforced by State and local agencies, each charged with enforcing the laws governing a specific media such as air, water, hazardous waste, solid waste, and pesticides. Enforcement agencies for these media are as follows:

- Air: ARB (part of CalEPA) and Local Air Districts.
- Water: SWRCB (part of CalEPA), RWQCBs (part of CalEPA), local waste water officials, and the California Department of Public Health.

- Hazardous Waste: Department of Toxic Substances Control (part of CalEPA) and CUPA.
- Carcinogens/Reproductive Toxins: Prop. 65 through the Office of Environmental Health Hazard Assessment (part of CalEPA).
- Pesticides: Department of Pesticide Regulation (part of CalEPA) and County Agricultural Commissioners

Statewide law enforcement service is provided by the California Highway Patrol, which is responsible for protecting State resources and providing crime prevention services and traffic enforcement along the State's highways and byways.

Community law enforcement service is provided by local police and sheriff agencies (i.e., cities and counties, respectively) to prevent crime, respond to emergency incidents, and provide traffic enforcement on local roadways.

2. Fire Protection and Emergency Medical Response Services

The United States Forest Service is an agency of the United States Department of Agriculture that administers the nation's 155 national forests and 20 national grasslands, which encompass 193 million acres (780,000 km^2), including fire protection and response services. Major divisions of the agency include the National Forest System, State and Private Forestry, and the Research and Development branch. The Fire and Aviation Management part of the US Forest Service works to advance technologies in fire management and suppression, maintain and improve the extremely efficient mobilization and tracking systems in place, and reach out in support of our Federal, State, and International fire partners.

State-level fire protection and emergency response service is provided by the California Department of Forestry and Fire Protection (CAL FIRE), primarily in rural areas of the State. CAL FIRE is an emergency response and resource protection department. CAL FIRE protects lives, property and natural resources from fire, responds to emergencies of all types, and protects and preserves timberlands, wildlands, and urban forests.

Local and urban fire protection service is provided by local fire districts and/or local agencies (e.g., fire departments of cities and counties). In addition to providing fire response services most fire agencies also provide emergency medical response services (i.e., ambulance services) within their service areas.

3. Schools

Education is primarily a state and local responsibility in the United States. States and communities, as well as public and private organizations, establish schools, develop curricula, and determine requirements for enrollment and graduation. Statewide, the regulation of education for youth is provided by the California Department of Education. The State Board of Education (SBE) is the governing and policy-making body of the California Department of Education. The SBE sets K-12 education policy in the areas of

standards, instructional materials, assessment, and accountability. Locally, school districts are responsible for the management and development of elementary, middle, and high-school facilities.

B. Regulatory Setting

Table 19: Applicable Laws and Regulations for Public Services	
Regulation	**Description**
Federal	**None applicable.**
American with Disabilities Act	Guidelines to ensure that facilities are accessible to individuals with disabilities. Implements requirements for the design and construction of buildings.
State	
State Fire Responsibility Areas	Areas delineated by the CAL FIRE for which the State assumes primary financial responsibility for protecting natural resources from damages of fire. Local jurisdictions are required to adopt minimum recommended requirements for road design, road identification, emergency fire suppression and fuel breaks and greenbelts. All projects within or adjacent to a State Fire Responsibility Area must meet these requirements.
State School Funding	Education Code Section 17620 authorizes school districts to levy a fee, charge, dedication, or other requirement for any development project for the construction or reconstruction of school facilities.

15.0 RECREATION

A. Existing Conditions

Recreational resources and facilities are provided and managed at federal, state, and local levels. The federal government manages a diverse array of recreation facilities and resources in California that include national parks and monuments, national forests and grasslands, wildlife refuges, wilderness areas, lakes and lands managed by different agencies in the federal government, wild and scenic rivers, and back country byways, national trials, and marine reserves and estuaries. USFWS manages the wildlife and fisheries resources and their habitats. Each federal agency's programs include recreation components

California has over 275 State beaches and parks, recreation areas, wildlife areas, historic parks, and museums, and has authority over fishing and hunting activities, habitat restoration and protection in the State. General plans for State parks, recreation areas, and beaches are publicly available. The California Outdoor Recreation Plan and associated research provide policy guidance to all public agencies – federal, state, local, and special districts that oversee outdoor recreation on lands, facilities and services throughout California Agencies and departments that have involvement in recreational

activities include Boating and Waterways, Fish and Wildlife, Tahoe Regional Planning Association, various conservancies, and others (California State Parks 2008).

Recreational lands and facilities are also managed by regional and local park and recreation agencies and open space districts. City and county general plans contain recreation elements that provide framework for planning agencies to consider when projects are developed and implemented.

B. Regulatory Setting

Table 20: Applicable Laws and Regulations for Recreation	
Regulation	**Description**
Federal	
FLPMA, 1976 – 43 CFR 1600	Establishes public land policy; guidelines for administration; and provides for the "multiple use" management, protection, development, and enhancement of public lands. "Multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people" with recreation identified as one of the resource values.
State	None applicable
Local	
General Plans	General plans for cities and counties contain designations for recreational areas. These are policy documents with planned land use maps and related information that are designed to give long-range guidance to those local officials making decisions affecting the growth and resources of their jurisdictions. Because of the number and variety of general plans and related local plans, they are not listed individually.

16.0 TRANSPORTATION AND TRAFFIC

A. Existing Conditions

Existing roadway systems in the project area generally consist of highways, freeways, arterials, local streets, and intersections/ramps. The existing average annual daily traffic (AADT) volumes on the roadway segments that comprise these systems vary considerably (i.e., from hundreds to hundreds of thousands). The level of service (LOS), a scale used to determine the operating quality of a roadway segment or intersection based on volume-to-capacity ratio (V/C) or average delay, also vary from LOS A, the best and smoothest operating conditions, to LOS F, most congested operating conditions. Other roadway and traffic volume characteristics such as roadway length, number of lanes and facility type (e.g., two-lane freeway), right-of-way width and pavement width, terrain classification (e.g., flat), percent of heavy-duty truck traffic, and

accident rates (e.g., number of accidents per million vehicle miles traveled) also vary substantially depending on the location. In addition to the roadway systems, circulation networks provide additional transportation opportunities and include mass transit, airports, and non-motorized travel (e.g., pedestrian and bicycle paths).

B. Regulatory Setting

Table 21: Applicable Laws and Regulations for Transportation and Traffic	
Regulation	**Description**
Federal	
40 CFR, Part 77 (FAA)	Requires a determination of no hazard to air navigation for structures that will be more than 200 feet above ground level.
State	
California Vehicle Code (VC) Sections 353; 2500-2505; 31303-31309; 32000-32053; 32100-32109; 31600-31620; California Health and Safety Code Section 25160 et seq.	Regulates the highway transport of hazardous materials.
VC Sections 13369; 15275 and 15278	Addresses the licensing of drivers and the classification of licenses required for the operation of particular types of vehicles and also requires certificates permitting operation of vehicles transporting hazardous materials.
VC Sections 35100 et seq.; 35250 et seq.; 35400 et seq.	Specifies limits for vehicle width, height, and length.
VC Section 35780	Requires permits for any load exceeding Caltrans weight, length, or width standards on public roadways.
California Streets and Highways Code Section 117, 660-672	Requires permits for any load exceeding Caltrans weight, length, or width standards on County roads.
California Streets and Highways Code Sections 117, 660-670, 1450, 1460 et seq., and 1480 et seq.	Regulate permits from Caltrans for any roadway encroachment from facilities that require construction, maintenance, or repairs on or across State highways and County roads.

17.0 UTILITIES AND SERVICE SYSTEMS

A. Existing Conditions

1. Water Supply and Distribution

The principal water supply facilities in California are operated by the United Stated Bureau of Reclamation (USBR) and DWR. The USBR is a federal agency and it is the

largest wholesaler of water in the U.S. and the second largest producer of hydroelectric power (USBR 2011a). In California, the Mid-Pacific Region of the USBR is responsible for the management of the Central Valley Project (CVP). The CVP serves farms, homes, and industry in California's Central Valley as well as the major urban centers in the San Francisco Bay Area. The CVP consists of 20 dams and reservoirs, 11 power plants, and 500 miles of major canals and reaches from the Cascade Mountains near Redding in the north to the Tehachapi Mountains near Bakersfield in the south. In addition to delivering water for municipal and industrial uses and the environment, the CVP produces electric power and provides flood protection, navigation, recreation, and water quality benefits (USBR 2011b).

DWR is a State agency that is responsible for managing and implementing the State Water Project (SWP). The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California (DWR 2010).

Local water districts, irrigation districts, special districts, and jurisdictions (e.g., cities and counties) manage and regulate the availability of water supplies and the treatment and delivery of water to individual projects. Depending on their location and the source of their supplies, these agencies may use groundwater, surface water through specific water entitlements, or surface water delivered through the CVP or SWP. In some remote areas not served by a water supply agency, individual developments may need to rely upon the underlying groundwater basin for their water supply. In these cases, the project would be required to secure a permit from the local or State land use authority and seek approval for development of the groundwater well(s).

2. Wastewater Collection and Treatment

The SWRCB is the State agency responsible for the regulation of wastewater discharges to surface waters and groundwater via land discharge. The SWRCB and nine regional water quality control boards (RWQCB) are responsible for development and enforcement of water quality objectives and implementation plans that protect the beneficial uses of the federal and State waters (SWRCB 2013). The State water board also administers water rights in California. The RWQCB's are responsible for issuing permits or other discharge requirements to individual wastewater dischargers and for ensuring that they are meeting the requirements of the permit through monitoring and other controls.

Wastewater collection, treatment, and discharge service for developed and metropolitan areas is typically provided by local wastewater service districts or agencies that may or may not be operated by the local jurisdiction (e.g., city or county). These agencies are required to secure treatment and discharge permits for the operation of a wastewater facility from the RWQCB. Wastewater is typically collected from a specific development

and conveyed through a series of large pipelines to the treatment facility where it is treated to permitted levels and discharged to surface waters or the land.

In areas that are remote or that are not served by an individual wastewater service provider, developments would be required to install an individual septic tank or other on-site wastewater treatment system. These facilities would need to be approved by the local or State land use authority and the RWQCB.

3. Electricity and Natural Gas

The CPUC regulates investor-owned electric and natural gas companies located within California. The CPUC's Energy Division develops and administers energy policy and programs and monitors compliance with the adopted regulations. One-third of California's electricity and natural gas is provided by one of three companies: Pacific Gas and Electric Company, Southern California Edison, San Diego Gas and Electric Company (CPUC 2010).

Locally, energy service is provided by a public or private utility. New development projects would need to coordinate with the local service provider to ensure adequate capacity is available to serve the development.

4. Solid Waste Collection and Disposal

Statewide, the California Department of Resources Recycling and Recovery (CAL Recycle), which is a department of the CNRA, is responsible for the regulation of the disposal and recycling of all solid waste generated in California. Cal Recycle acts as an enforcement agency in the approval and regulation of solid waste disposal and recycling facilities. Local agencies can create local enforcement agencies and, once approved by Cal Recycle, they can serve as the enforcement agency for landfills and recycling facilities with their jurisdictions.

Local agencies or private companies own and operate landfill facilities and solid waste is typically hauled to these facilities by private or public haulers. Individual projects would need to coordinate with the local service provider and landfill to determine if adequate capacity exists to serve the project.

B. Regulatory Setting

Table 22: Applicable Laws and Regulations for Utilities

Regulation	Description
Federal	None applicable
State	
Waste Heat and Carbon Emissions Reduction Act of 2007	The Waste Heat and Carbon Emissions Reduction Act of 2007 (AB 1613), placed requirements on the CPUC, the CEC, and local electric utilities to develop incentive programs and technical efficiency guidelines to encourage the installation of small CHP

Table 22: Applicable Laws and Regulations for Utilities	
Regulation	**Description**
	systems. The CEC approved efficiency and certification guidelines for eligible systems under AB 1613 in January 2010, and the CPUC approved standardized contracting and pricing provisions between CHP operators and the Investor Owned Utilities in November 2012.
CPUC, Section 95-08-038	This section contains the rules for planning and construction of new transmission facilities, distribution facilities, and substations. The CPUC requires permits for the construction of certain power line facilities or substations if the voltages would exceed certain thresholds.
Section 21151.9 of the PRC/ Section 10910 et seq. of the Water Code	Required the preparation of a water supply assessment (WSA) for large developments. These assessments are prepared by public water agencies responsible for providing service and address whether there are adequate existing and projected future water supplies to serve the proposed project. All projects that meet the qualifications for preparing a WSA must identify the water supplies and quantities that would serve the project as well as project the total water demand for the service area (including the project's water demands) by source in 5-year increments over a 20-year period. This information must include data for a normal, single-dry, and multiple-dry years. The WSA is required to be approved by the water service agency before the project can be implemented.

ATTACHMENT 3: PRIOR ENVIRONMENTAL ANALYSIS

1.0 TRANSPORTATION SECTOR

A. 2008 Scoping Plan Overview

The initial Scoping Plan addressed the transportation sector as the largest contributor to GHG emissions in the State, including transportation fuels, land use, infrastructure, and travel activity. In 2011, transportation activities contributed 38 percent of the GHG emissions in California. The initial Scoping Plan contained three overarching GHG emission reduction strategies for this sector: more efficient vehicles, lower-carbon fuels, and reduction of vehicle use or vehicle miles traveled (VMT).

California's GHG emission reduction efforts on transportation began in 2002 when the Legislature passed AB 1493 (Pavley, Chapter 200, Statues of 2002), the Pavley bill. ARB approved regulations to implement the Pavley bill in 2004. Specific GHG emission reduction measures for the transportation sector included reducing GHG emissions from cars, reducing the carbon content of fuels, a reduction of vehicle use or VMT, and inclusion of transportation fuels in the Cap-and-Trade regulation. To date, regulations are in place to achieve 23 million metric tons (MMT) of GHG emission reductions in 2020. Reductions have been largely, but not exclusively, focused on light-duty vehicles, and are being achieved through a three-pronged approach: 1. Regulations, 2. Incentives, and 3. Transportation, land use, and housing planning.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the transportation sector measures is provided in Table 1. More details about measures that have been implemented since 2008 and a summary of their associated environmental analyses, follow this table.

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED

Measure *(Status/Consideration Date)*	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(T-1) Pavley I and II – Light –Duty Vehicle Greenhouse Gas Standards[2] (*January 2012)*	No adverse environmental impacts anticipated.	None necessary.
(T-2) Low Carbon Fuel Standard – includes	**Aesthetics** – This measure is undergoing	Any impacts would be assessed on a location and project- specific

[2]Measure T-1 in the initial Scoping Plan was referred to as "Pavley I and II – Light –Duty Vehicle Greenhouse Gas Standards." The new title for the measure as discussed in the Update, Advanced Clean Cars, builds upon the Pavley I and II GHG emission standards. See the discussion of Advanced Clean Cars below.

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
facilities for ethanol and biodiesel production; use of hydrogen and electricity as alternative fuels. *(April 2009, early action item)*	regulatory development.	basis.
	Air Quality - Ethanol production requires the use of thermal and electrical power. Process steam production is the primary source of criteria pollutant emissions. The largest sources of PM_{10} are associated with grain handling, and the largest sources of VOCs are associated with the fermentation, distillation, storage, and loading of the ethanol produced.	Procure VOC emissions offsets. Employ best available control technologies which may include Ultra-Low NO_X burners on steam boilers, baghouses for PM control, and wet scrubbers to control VOC emissions. Site facilities near truck or rail terminals, consider proximity to feedstocks or users of ethanol products to minimize transport emissions.
	Hydrogen can be a low-carbon fuel. Can be used in either modified internal combustion engines or in fuel cells. Combusting hydrogen produces heat, water, and may produce minor NO_X emissions.	Should be quantified and measures to mitigate identified in regulatory process.
	Agricultural Resources - Siting of new stationary sources, such as ethanol facilities, or facilities that convert biomass to fuel may convert prime farmland to other uses – the degree of which would be determined locally, and may conflict with an existing Williamson Act contract.	Avoid siting on prime agricultural lands, lands under Williamson Act contract, support of the California Farmland Conservancy Program. Such facilities would require a local approval of conditional use permits, local air permits, and other permits and would be subject project-specific compliance with CEQA.
	Biological Resources –	Project-specific CEQA

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	When converting natural lands, there may be adverse impacts to terrestrial, riparian or aquatic habitat, natural communities or to an species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations or by the California Department of Fish and Game (CDFW), the US Fish and Wildlife Service (USFWS) or ins 404 of the Clean Water Act. Interference with movement in corridors. **Cultural Resources –** Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction. **Energy Demand** - Future ethanol production facilities in California will likely use natural gas to produce steam and purchase required	compliance will be necessary. Project-specific CEQA compliance will be necessary. Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided. Employ efficiency and control technologies at existing facilities. Recycle, reuse or reprocess wastes. Wastes that cannot be recycled, reused or reprocessed must be disposed of appropriately.

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	electricity from a utility.	
	Hazards and Hazardous Materials – Some of the pathways may generate waste that may contain hazardous materials	Check with County to ensure conformity with Contract, file for nonrenewal if nonconforming.
	Land Use and Planning – Conversion of crops from food and fiber to fuel crops may conflict with Williamson Act contract.	Should be discussed and analyzed in the LCFS regulatory development process.
	Water Resources Water Quality – chemicals and fertilizers used on crops can end up in surface or ground waters, affecting water quality. There may be potential adverse impact to water quality from formulation of low-carbon fuels in the event of spills.	Employment of appropriate spill prevention and spill abatement protocols.
(T-3) Regional Transportation-Related Greenhouse Gas Reduction Targets	**Land Use Policies** - May conflict with existing land use policies in some regions of the State.	Any land use policy conflicts will be resolved at regional and local levels in a collaborative process.
Congestion Pricing, Indirect Source Rule, Education and outreach efforts, and Pay as You Drive Insurance support to this measure	Congestion Pricing – May increase vehicle use on off-hours but would result in no net increase in emissions.	Separate environmental evaluation needed.
	Indirect Source Rule for	Separate evaluation needed to

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(Targets Approved September 2010. Major urban regions have adopted SCSs that meet, and in some cases exceed, the targets)	New Development – requires separate environmental evaluation. Education – no adverse impacts anticipated. Pay as You Drive – Dept. of Insurance is pursuing.	adopt regulations. None necessary.
(T-4) Vehicle Efficiency Measures (tire inflation, use of low friction oils, cool paints and fuel efficient passenger vehicle replacement tires)	No adverse environmental impacts anticipated, but further analysis will be completed to verify.	None necessary.
(T-5) Ship Electrification at Ports *(December 2006,early action item)*	**Air Quality** – Indirect impacts from criteria pollutant emissions associated with incremental electricity generation at power plants. **Energy Demand** - May increase energy demand.	These emissions are significantly less than emissions generated by ship engines. Environmental evaluation completed as part of regulation. Employ off-peak charging
(T-6) Goods Movement Port trucks, drayage *(December 2006,early action item)*	Analyzed in separate FED.	
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Vessel Speed Reduction (VSR) – exploring the requirement to reduce speed Cleaner ships – Design and fuel efficiency strategies	No adverse environmental impact anticipated, but will need additional analysis. Analyzed in 2007 SIP FED.	Conceptual at this time, not quantified. No additional analysis necessary. Adopted.

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
Commercial Harbor Craft – voluntary action to use alternative anti-fouling agent	**Hazards and Hazardous Materials** - Anti-fouling agents to improve hull smoothness may contain copper. This measure encourages the use of alternative agents with no copper. Disposal of residual copper-containing agents may have an adverse impact.	Encourage non-toxic anti-fouling product use and education of owners/operators on the toxicity of copper to reduce use and improper disposal of these chemicals.
Cargo handling	No adverse environmental impact anticipated, but additional analysis will verify.	May require further analysis.
Transport Refrigeration Units (TRU) *(Sub-measures 2–7 and others are being considered in the development of the 2014 Sustainable Freight Strategy)*	**Energy Demand** -TRUs may increase energy demand by electrification.	Employ off-peak charging to balance electrical load.
(T-7) Heavy Duty Vehicle Greenhouse Gas Emission Reduction – Aerodynamic Efficiency *(December 2008, early action item; anticipated late 2013)*	Regulation and associated impacts are currently being evaluated in separate EA, scheduled for Board hearing and adoption in December 2013.	
(T-8) Medium and Heavy-Duty Vehicle Hybridization *(April 2009, early action*	No adverse impacts anticipated with efficiency measures, however some technologies are in research and development phase. Further evaluation	None necessary at this time.

Table 1 Summary of Transportation Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
item)	will verify.	
(T-9) High Speed Rail	Impact analysis incorporated by Reference into 2008 FED, SCH# 2001042045, Potential and cumulative impacts include aesthetics, displacement of commercial and residential properties, disproportionate impacts to minority and low-income populations, community and neighborhood disruption, increased noise and electromagnetic interference along rail corridors, land use policies, traffic impacts associated with stations, effects to historic properties or archaeological sites, impacts to parks and recreation resources, exposure to seismic and flood hazards, water resources, wetlands and sensitive biological species and habitat, land use compatibility, energy use and impacts to agricultural resources.	Programmatic EIR/EIS was prepared in 2001, followed by project environmental documents. Mitigation measures incorporated by reference into the 2008 FED.

After adoption of the initial Scoping Plan, the following programs were developed and implemented in furtherance of the measures identified above in Table 1. As part of adoption of these programs, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate, as summarized below.

1. Advanced Clean Cars

The Advanced Clean Car (ACC) Program, approved in 2012, builds upon the Pavley I and II GHG emission standards, and combines three programs to control smog-forming, particulate matter, toxic air contaminant (TAC), and GHG emissions in a single coordinated package of requirements for model years 2015 through 2025. One goal of the regulations is to promote the development of environmentally superior cars that will continue to deliver the performance, utility, and safety vehicle owners have come to expect.

The ACC Program involved amendments to existing regulations for Low-Emission Vehicles (LEV III), Zero-emission Vehicles (ZEV), and Clean Fuels Outlets (CFO). To achieve further criteria emission reductions from the passenger vehicle fleet, several amendments were adopted to represent a significant strengthening of the existing LEV program. The LEV amendments included improvements to consumer labeling, patterned on California's revolutionary environmental performance label (EPL), to provide important emissions information in a graphical, easy-to-understand format. The ZEV program focused on vehicle technology development by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles in the 2018-2025 model years. The amendments to the CFO regulation were designed to assure ultra-clean fuels, such as hydrogen, are available to meet vehicle demands resulting from the projected increase in number of ZEVs operating in the State.

The environmental analysis prepared for the ACC Program was based on the expected compliance responses of the regulated communities covered by the ACC (ARB 2011a) The environmental analysis concluded that the compliance responses to the ACC would result in beneficial impacts to air quality through reductions in emissions, including greenhouse gases, CAPs, and TACs. It further concluded that the proposed ACC would result in less-than-significant impacts to agricultural and forest resources, land use, minerals, noise, population and housing, public services and recreation. The environmental analysis concluded there could be potentially significant adverse impacts to aesthetics, air quality (related to construction), biological resources, cultural resources, geology/soils, hazards (related to accidental releases), hydrology/water quality, traffic and utilities, largely due to construction activities related to the CFO regulation (ARB 2011a). The ACC regulations were adopted by the Board in March 2012 but the CFO regulation was never finalized.

In September 2013, ARB released proposed amendments to the ZEV regulation that would adjust the optional Section 177 state compliance path provision, define how caps apply to a manufacturer's requirements, and disallows battery swapping to qualify under the fast refueling definition for Type IV and V ZEVs. The environmental analysis, included in Chapter 4 of the ISOR prepared for the amendments and released for a 45-day comment period, concluded that implementing the proposed amendments to the ZEV regulation would not result in any potentially significant adverse impacts on the environment.

2. Low Carbon Fuel Standard

The Low Carbon Fuel Standard (LCFS), developed in 2009 and effective in 2010, is designed to reduce the GHG emissions from California's consumption of transportation fuels by providing a durable framework that uses market mechanisms to spur the steady introduction of lower carbon fuels. The framework establishes performance standards that fuel producers and importers must meet each year beginning in 2011. The standards are "back-loaded," meaning there are more reductions required in the last five years than the first five years. This schedule allows for the development of advanced fuels that are lower in carbon than today's fuels and the penetration of plug-in hybrid electric vehicles, battery electric vehicles, fuel cell vehicles, and flexible fuel vehicles. ARB anticipates that compliance with the LCFS will be based on a combination of strategies involving lower carbon fuels and more efficient, advanced-technology vehicles.

Reformulated gasoline mixed with corn-derived ethanol at 10 percent by volume and low sulfur diesel fuels represent the baseline fuels. The LCFS does not ban the production, import or use of any individual fuel—regardless of carbon intensity—but the regulation's aggregate carbon intensity standard serves to incentivize the use of lower-carbon alternatives to gasoline and conventional diesel. For example, lower carbon fuels may be lower-carbon ethanol, biodiesel, renewable diesel, natural gas, biomethane, hydrogen, or electricity. The LCFS's flexible framework also encourages the development of completely new fuels with lower carbon intensities.

As noted in the environmental analysis prepared for the LCFS program, the program is anticipated to provide beneficial environmental impacts associated with air quality and annual reductions of 15 MMT of GHG emissions by 2020 (ARB 2009a).

In October of 2011, ARB released proposed amendments to the LCFS regulation. The environmental analysis, included in Chapter 5 of the ISOR prepared for the amendments and circulated for a 45-day comment period, concluded the proposed amendments to the LCFS regulation would not result in any potentially significant adverse impacts on the environment. Those amendments were finalized in October of 2012, became effective November 26, 2012, and were implemented on January 1, 2013.

The LCFS has been the subject of three lawsuits against ARB. Most recently, in the state court lawsuit filed by Poet LLC in December 2009 that involves CEQA and other claims, the Fifth District Court of Appeal issued an opinion in July 2013 that allows the LCFS standards to remain operative while ARB takes corrective action directed by the court for compliance with CEQA and the APA.

3. Regional Transportation-Related Greenhouse Gas Target

Senate Bill (SB) 375 aligns regional land use, transportation, housing, and GHG emission reduction planning efforts. SB 375 requires ARB to set regional GHG emission

reduction targets for passenger vehicles and light trucks for 2020 and 2035. (Gov. Code, § 65080, subd. (b)(2)(A).) The targets are for the 18 metropolitan planning organizations (MPOs) in California. The MPOs must develop a Sustainable Communities Strategy (SCS) as part of their Regional Transportation Plans (RTPs) to demonstrate how they will achieve the targets, if it is feasible to do so. If it is not feasible for the MPO to achieve its target through an SCS, then the MPO must prepare an Alternative Planning Strategy (APS) which is independent of the RTP.

Targets for each of the MPOs were approved by ARB in September 2010. Major urban regions have adopted SCSs that meet, and in some cases exceed, the targets. SB 375 requires CEQA Compliance for MPOs adopting SCSs. At the time of release of the Plan Update, SCSs had been adopted by the San Diego Association of Governments, Southern California Association of Governments, Sacramento Area Council of Governments, Tahoe Metropolitan Planning Organization/Tahoe Regional Planning Agency, Butte County Association of Governments, Santa Barbara County Association of Government, and the Association of Bay Area Governments / Metropolitan Transportation Commission.

According to the environmental analysis prepared by ARB when setting the targets pursuant to SB 375, impacts associated with SCSs would generally be beneficial and provide: increased mobility, economic benefits, reduced air and water pollution, conservation of open space, farmland, and forest land, healthier, more equitable and sustainable communities. Significant adverse environmental impacts were described for air quality, traffic congestion, population growth, displacement of residents, utilities and services, noise, light and glare, and aesthetic/visual impacts. Mitigation measures were described that could reduce these impacts. MPOs are required to prepare their own specific Environmental Impact Reports (EIR) for SCSs and/or RTP updates, pursuant to CEQA and determine project-level impacts and develop appropriate mitigation measures, as feasible (ARB 2010a).

4. Regulation for Under Inflated Vehicle Tires

The regulation for Under Inflated Vehicle Tires, adopted in September 2010, applies to automotive service providers (ASPs) performing or offering to perform automotive maintenance or repair services in California. Staff estimated there are approximately 40,000 ASPs in California that are subject to this regulation. Except for under limited circumstances, it requires ASPs to perform a tire pressure service (check and inflate) on all passenger vehicles that are brought in to the facilities for service or repair. This includes passenger cars, light duty trucks, medium duty vehicles, and light heavy duty trucks with gross vehicle weight ratings (GVWR or GVR) of less than or equal to 10,000 pounds. These requirements apply to ASPs that perform engine maintenance, smog checks or routine service such as oil changes on any passenger vehicle. Examples of ASPs that are not affected include automotive car washes, body and paint facilities, and glass repair.

As noted in the Initial Statement of Reasons for the Regulation for Under Inflated Vehicle Tires, ARB concluded that implementation of this regulation would result in GHG emission reductions and would not result in any significant adverse public health or environmental impacts (ARB 2009b).

5. Heavy Duty Vehicle GHG Emission Reduction

The initial Scoping Plan included a measure for Phase 1 of the regulation. Proposed Phase I regulatory language that amended several existing regulations was released for public review and comment on October 23, 2013. The Board approved the proposed regulations in December 2013. The Phase 1 GHG regulations establish GHG emission standards and test procedures for medium- and heavy-duty engines and vehicles with gross vehicle weight rating (GVWR) over 8,500 pounds, and phase in between model years (MY) 2014 and 2018.

California's Phase I GHG regulation harmonizes with the Phase I GHG emission standards already adopted by the U.S. Environmental Protection Agency (US EPA) in 2011, providing California with the ability to certify engines and vehicles to these standards and enforce the requirements in California. As described in the environmental analysis in the Staff Report prepared for this regulation, no adverse impacts result from implementation of this regulation.

6. High-Speed Rail

The purpose of the proposed High Speed Rail (HSR) system is to provide a reliable mode of travel, which links the major metropolitan areas of the state and delivers predictable and consistent travel times. Further objectives are to provide an interface with commercial airports, mass transit, and the highway network and to relieve capacity constraints of the existing transportation system as intercity travel demand in California increases, in a manner sensitive to and protective of California's unique natural resources. The system needs to be practicable and feasible as well as economically viable. The system should maximize the use of existing transportation corridors and rights-of-way, be implemented in phases, and be completed by 2020.

As noted in the Program EIR/EIS for the California High-Speed Train System, developed in 2004 by the California High-Speed Rail Authority, HSR would have potentially significant environmental impacts, including effects on noise, biology, wetlands, and farmlands. It would have beneficial impacts to energy savings, reduced air pollutant emissions, and improved intercity travel conditions. The overall HSR program was adopted in November 2005. The Merced-to-Fresno section of the program was approved in May 2012 under CEQA, and September 2012 under NEPA. Project-level planning and environmental analysis of individual sections is on-going (California High-Speed Rail Authority 2013). The HSR Project has been the subject of lawsuits that have challenged the Program EIR/EIS and subsequent CEQA documents. The most recent case, *Town of Atherton et al v. California High Speed Rail Authority*, is pending in the California Court of Appeal, Third District, as of the time of this EA.

2.0 ENERGY SECTOR (ELECTRICITY AND NATURAL GAS)

A. 2008 Scoping Plan Overview

California's Energy Sector includes a complex system of production, transmission and distribution, and end uses of electricity and natural gas. Presently, about 40 percent of the State's total GHG emissions are associated with the Energy Sector, therefore, efforts to reduce energy-related emissions are a key component of the Scoping Plan.

The initial Scoping Plan envisioned achieving the majority of the GHG emission reductions for the Energy Sector from four key programs: building and appliance energy efficiency standards; the 33 percent Renewable Portfolio Standard (RPS); the Million Solar Roofs program; and the Cap-and-Trade Regulation. The initial Scoping Plan also included transportation-related programs that affect energy-sector emissions, such as port electrification requirements and increased penetration of electric vehicles. The status of these programs was discussed in the previous section. The Energy Sector was tasked with achieving 25 MMT of GHG emission reductions by 2020, with almost half of the reductions from energy efficiency programs.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the Energy Sector measures is provided in Table 2. More details about measures that have been implemented since 2008, and a summary of their associated environmental analyses, follow this table.

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED

Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(E-1 and CR-1) Energy Efficiency *(2013 Building standards adopted and begin implementation January 1, 2014; CEC adopted and implemented standards for battery chargers and television sets. New standards for*	**Hazards and Hazardous Materials**- Efficiency Standards may occasionally result in the use of new or new versions of products that contain hazardous materials and require special recycling or disposal.	Compliance with applicable hazardous materials recycling and disposal laws. Disposal of hazardous waste would occur at an appropriated permitted disposal facility.

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
other appliances are currently under development.; Utility Energy Efficiency Programs are being implemented)		
(E-2) Increasing Combined Heat and Power *(AB1613, enacted in 2007, being implemented. CPUC adopted standard contracts for CHP systems and set targets for CHP procurement)*	**Air Quality** –No adverse air quality impacts are anticipated, unless individual CHP units are installed in a way that is not conforming to the measure design.	Use of best available control technology (BACT). These units are permitted through the Air Districts. Location and project-specific CEQA analysis may be required.
(E-3) Renewables Portfolio Standard *(SBx1 2, enacted in 2011, being implemented by CPUC, CEC, and publically owned utilities)*	**Aesthetics** - siting and construction of wind or solar farms that would support the expansion of the Renewables Portfolio Standard (RPS) may affect viewsheds. **Agricultural Resources** - Siting of new utility scale facilities and arrays may convert prime farmland to other uses – the degree of which would be determined locally, and may conflict with an existing Williamson Act contract.	Careful design and siting of these facilities will avoid impacts, consistent with available CEC and Department of Fish and Game (DFG) guidance documents and siting requirements of federal agencies. Project- specific analysis would be necessary. Avoid siting on prime agricultural lands, lands under Williamson Act contract. If unavoidable, support of the California Farmland Conservancy Program. Such facilities would require a local approval of conditional use permits, and other permits and would be subject project- specific compliance with CEQA.

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	Air Quality – Biomass facilities siting and operations may cause an increase in nitrogen oxide, sulfur dioxide, particulate matter (PM_{10} and $PM_{2.5}$).	Use of BACT, such as catalytic converters and filtration. Location and project specific impact analysis will be necessary.
	Biological Resources - Any utility scale facility may require a relatively large area if it is to be used to generate electricity at a commercial scale, and large arrays of solar collector may interfere with natural sunlight, rainfall, drainage which could have a variety of impacts on plants and animals. Solar arrays may also create avian perching opportunities that could affect both bird and prey populations. A wind farm may present a potential risk to migrating birds if the facility is sited in a migratory flyway.	Location-specific impact analysis will be necessary. Careful design and siting of wind farms, turbines and infrastructure would minimize the risk for bird strikes. Advances in turbine and wind farm design have resulted in fewer, more powerful turbines and better protection for birds. Use of guidelines by CEC and DFG.
	A solar thermal plant requires around 50 times more land than combined cycle natural gas fueled power plant per megawatt (MW). Construction activities associate with solar thermal plants disturb the land, and fencing can interfere with wildlife corridors.	Specific impacts depend on biological characteristics of the land being developed. Sensitive populations and habitat should be avoided.
	Nitrogen dioxide deposition from cooling towers at solar thermal plants and new geothermal projects degrade vegetation.	Use of BACT. Provision of habitat compensation, revegetation.
	Cultural Resources – Future facilities in California may involve	Project-specific compliance with CEQA and/or NEPA would be

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
	Hazards and Hazardous Materials – Municipal solid waste may contain hazardous materials, which could result in solid and gaseous hazardous by-products.	Ash can be recycled or shipped to landfills permitted to accept such waste, and hazardous materials should be diverted prior to combustion.
	Land Use and Planning – Siting of new utility scale facilities and arrays may conflict with an existing Williamson Act contract, or lands under easement. Conversion of crops from food and fiber to fuel crops may conflict with existing Williamson Act contract.	Avoidance would be most appropriate mitigation. If land is under easement, conditions must allow use. Such facilities would require a local approval of conditional use permits, and other permits and would be subject project- specific compliance with CEQA.
	It is foreseeable that additional transmission infrastructure will be necessary to help support the RPS requirements to deliver renewable power to consumers.	Check with County to ensure consistency with Contract.
	Noise – Powerplants and wind power installations may increase ambient noise levels.	Siting of transmission facilities is subject to project specific CEQA analysis by the CPUC.
	Recreation (see Aesthetics)	General Plan Noise Elements and ordinances identify appropriate local noise levels and accepted mitigation measures such as

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
		mufflers, limited hours of operations and installation of sound barriers. USDI Bureau of Land Management is preparing an environmental impact statement (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008) that precludes (as mitigation) the siting of solar arrays from lands within the National Landscape Conservation System, such as National Conservation Areas, National Monuments, Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers and National Historic and Scenic Trails, and lands that have been identified as environmentally sensitive.
(E-4) Million Solar Roofs *(Greater than 1,400 MW installed to date*)	**Aesthetics** - Roof top solar panels and solar water heaters may adversely affect a neighbor's quality of rooftop views, however, this is a subjective value. These measures may limit where trees may be planted in order to preserve solar access. **Hazards and Hazardous Materials** – Solar panels may leak if mishandled and broken. Photovoltaic panels may contain hazardous materials, and although they are sealed under normal operating conditions, there is the potential for environmental contamination if they were damaged or improperly	The significance to aesthetic values would be location specific. Proper handling and operation and good maintenance practices can be used to minimize impacts from hazardous materials (Federal Register/ Vol. 73, No. 104, Notices, May 29, 2008).

Table 2 Summary of Energy Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	disposed upon decommissioning. Concentrating solar power system may employ liquids such as oils or molten salts that may be hazardous and present spill risks. Various fluids commonly used in most industrial facilities, such as hydraulic fluids, coolants, and lubricants and may present a spill related risk.	

After adoption of the initial Scoping Plan, the following proposed program in the electricity sector was developed by ARB in furtherance of the measures identified above in Table 2. As part of preliminary adoption of this proposal, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate as summarized below.

1. Renewable Electricity Standard

The Renewable Electricity Standard (RES) was developed for the purpose of reducing emissions of GHGs in California. The RES advanced the standard for the proportion of electricity generation by eligible renewable sources from 20 percent, as established in 2002 by the California RPS, to 33 percent.

In 2010, ARB prepared an EA to assess the potential environmental impacts of a regulation proposed to implement the 33 percent standard. The EA and regulation, however, were never finalized because the Legislature passed, and the Governor signed, SBX1-2 (the California Renewable Energy Resources Act) in 2011. SBX1-2, being implemented by the California Public Utilities Commission, the California Energy Commission, and publically owned utilities, obligates all California electricity providers to obtain at least 33 percent of their energy from renewable resources by the year 2020.

3.0 WATER SECTOR

A. 2008 Scoping Plan Overview

For purposes of the initial Scoping Plan, the water sector includes groundwater and surface water resources and the infrastructure for its storage, conveyance, use, treatment, and recycling from these sources. The storage, conveyance and treatment of water in California consume large amounts of electricity. Approximately 19 percent of

the electricity and 30 percent of non-power plant natural gas consumption is used by the water sector to grow crops, support urban and industrial needs, and produce energy. Therefore, most of the water measures included in the initial Scoping Plan focused on the GHG emission benefits derived from reduced energy use, and the emission benefits are reflected in those sectors.

California's 2009 Water Conservation Act (Senate Bill X7-7) specifically addresses urban and agricultural water conservation. The Act's key urban provision established an aggressive statewide goal to reduce per capita water use by 20 percent by 2020. To date, 400 urban water agencies have prepared water management plans, which cover close to 80 percent of California's population.

The State has also set ambitious goals for development of alternative water sources such as recycled water and storm water. Grant and loan programs have provided over $1.15 billion for recycling and storm water capture infrastructure, and projects are coming online.

In addition, the State has invested $1.5 billion to support 48 regional collaborative efforts to develop water management plans, diversify regional water portfolios, and increase regional water supply self-reliance to support future growth and development. Governor Brown has also taken action to reduce water use consumption by directing State agencies and departments to reduce their overall water use by 10 percent by 2015 and 20 percent by 2020.[3]

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the water sector measures is provided in Table 3.

Table 3 Summary of Water Sector Environmental Impacts in the 2008 FED

Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(W-1) Water Use Efficiency *(State agencies are reducing water usage)*	Ongoing program administered by various state agencies.	None necessary.
(W-2) Water Recycling *(State Water Resources Control Board (SWRCB) is funding recycled water development projects)*	**Air Quality** - Installation of water recycling infrastructure would require construction activities, potentially generating typical short-term construction impacts such as dust generation,	Local jurisdictions and Air Pollution Control Districts typically require measures to mitigate construction impacts such as preparation of grading plans, dust minimization, minimizing idling of equipment and restriction of hours of

[3] See Executive Order B-18-12, issued on April 25, 2012.

Table 3 Summary of Water Sector Environmental Impacts in the 2008 FED		
Measure *(Status/Consideration Date)*	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	equipment emissions and objectionable odors.	operation.
	Biological Resources – Water recycling has the potential to reduce wastewater discharges, potentially modifying downstream environments and potentially impacting protected habitats and /or species. Project implementation has the potential to adversely impact biological resources located on project sites, along pipeline corridors and in proximity to construction zones.	Site specific field survey and mitigation may be warranted, and project-level CEQA compliance would be accomplished by appropriate lead agencies as individual projects are considered.
	Cultural Resources – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
	Energy Demand – Water recycling could increase the amount of energy used at local wastewater treatment facilities.	Wherever possible, water recycling would be performed during off-peak periods.
	Land Use and Planning	Site specific, project-level CEQA

Table 3 Summary of Water Sector Environmental Impacts in the 2008 FED		
Measure *(Status/Consideration Date)*	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	– Projects may conflict with habitat conservation plan or natural community conservation plan. **Population and Housing** – The availability of recycled water may represent an additional water supply that may foster community growth. **Water Resources/Water Quality** – Water recycling reduces the quantity of water entering into downstream flows, water table recharge, and infiltration. If wastewater is relied upon for dilution, this reduction could contribute to higher concentrations of contaminants in downstream waters and/or in water tables.	compliance would be accomplished by appropriate lead agencies. Availability of water supply created by recycling may be considered during General Plan updates and development proposals. Project-level CEQA evaluation would be necessary. This additional water supply is not considered an adverse impact. All water recycling facilities must be permitted and operated in accordance with the requirements of the Water Boards and the Department of Public Health. Project level CEQA compliance would be accomplished by appropriate lead agencies on a project-level basis. Project-specific analysis would be necessary. Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
(W-3) Water System Energy Efficiency	**Agricultural, Biological Resources** - New support	Similar mitigations to W-2. Project-specific evaluations

Table 3 Summary of Water Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(CEC has adopted standards for water efficiency. *CPUC has ordered IOUs to invest in energy and water efficiency)*	facilities may convert or disturb agricultural or natural lands. **Cultural Resources** – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	would be necessary and CEQA compliance would be performed by the appropriate lead agencies. Project-specific analysis would be necessary. Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.
(W-4) Reuse Urban Runoff *(SWRCB is funding numerous storm water reuse projects)*	**Air Quality** – Construction of water capture and storage facilities would produce short-term construction impacts. **Biological Resources** – Construction has the potential to impact sensitive species that exist on project sites. **Cultural Resources** – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if	Project-specific analysis would be necessary for new facilities. Compliance with Authority to Construct permit. Project-specific analysis necessary. Project-specific compliance with CEQA and/or NEPA would be required. The lead and implementing agencies would be required to contact the appropriate agencies and departments to ensure that potential impacts to cultural resources would be minimized or avoided.

Table 3 Summary of Water Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
	inadvertent disturbance occurs during construction.	
(W-5) Increase Renewable Energy Production *(DWR is contracting from renewable energy projects. The CEC is researching biogas technologies.)*	**Agricultural Resources** – New support facilities may convert or disturb agricultural lands. **Air Quality** – Construction of new facilities would produce short term construction impacts. **Biological Resources** – Construction has the potential to impact sensitive species that exist on project sites. **Cultural Resources** – Future facilities in California may involve siting, grading, construction or expansion on lands that have not been surveyed for cultural significance, and may result in adverse impacts to cultural resources if inadvertent disturbance occurs during construction.	None necessary.
(W-6) Public Goods Charge for Water *(The program has been evaluated but is not being implemented at this time.)*	No direct adverse environmental impacts are anticipated, as this measure is a potential funding source.	

4.0 GREEN BUILDINGS

A. 2008 Scoping Plan Overview

Buildings represent the second largest source of statewide GHG emissions when accounting for electricity, natural gas, and water consumption during ongoing operations and maintenance. Additional GHG emissions also result from the mining, harvesting, processing, and transportation of materials used to construct new buildings, as well as products consumed over the life of a building. The siting and integration of buildings into communities may affect transportation patterns and infrastructure needs and result in varying GHG emission impacts. Residential energy retrofits are also an important avenue for increasing energy efficiency and reducing GHG emissions. As the largest construction industry sector, residential construction affords the greatest potential for maximizing the benefits of green technologies. Emission reductions from green buildings are reflected in the electricity and natural gas sectors.

To address the impacts of GHG emissions from buildings, the initial Scoping Plan included a Green Building Strategy to expand the use of green building practices and reduce the carbon footprint of California's buildings. The initial Scoping Plan acknowledged that the design and construction of new green buildings, as well as the sustainable maintenance, operation, and renovation of existing buildings, would result in significant GHG emission reductions.

The initial Scoping Plan identified a single Green Building measure, "GB-1," with a broad description of potential actions or strategies by building type, including greening new and existing State buildings, public schools, residential housing, and commercial buildings. Since 2008, the Green Building measure has been implemented under four key programs and initiatives; the State Green Building Initiative (Executive Order B-18-12), California Green Building Standards (CALGreen) Code, Beyond Code, and Existing Building Retrofits, which collectively form the basis for the strategy.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with Green Buildings is provided in Table 4.

Table 4 Summary of Green Buildings Environmental Impacts in the 2008 FED

Green Buildings ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(GB-1) Green Buildings (Also includes Greening Public Schools, New Residential and Commercial Construction, and Existing Homes and Commercial Buildings)	No adverse environmental impacts anticipated, further analysis would verify	None necessary.

(Green Buildings Executive Order B-8-12, signed April 2012. California Building Standards Commission adopted the 2010 CALGreen codes. 2013 CALGreen codes become effective January 2014. Over 100 local governments have adopting green building standards that are more stringent than State standards. CEC is implementing AB 758.)		

5.0 INDUSTRY SECTOR

A. 2008 Scoping Plan Overview

The Industry sector covers a broad and diverse range of sources, including cement plants, refineries, power plants, glass manufacturers, and oil and gas production facilities. Industrial sources play a significant role in the State's vast economy and accounted for about 21 percent of California's total GHG emissions in 2011. These GHG emissions result primarily from stationary source combustion processes, such as boilers and furnaces. The initial Scoping Plan identified the Cap-and-Trade Program, and the use of innovative technology and ideas to meet the requirements placed on the industrial sector.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the industry sector measures is provided in Table 5. More details about measures that have been implemented since 2008, and a summary of their associated environmental analyses, follow this table.

Table 5 Summary of Industry Sector Environmental Impacts in the 2008 FED

Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources *(July 2010)*	Audits would have no adverse impacts at this time; however, results of audit will determine whether any further actions are necessary.	None necessary.
(I-2) Oil and Gas Extraction GHG Emissions Reduction – Best Management Practices and technologies to reduce	No adverse environmental impact anticipated, but additional analysis will verify.	Separate environmental evaluation will be conducted during regulatory development.

Table 5 Summary of Industry Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
fugitive emissions from venting and leaks from wells, process equipment, separation and storage. Increase compressor capacity Remove existing regulatory fugitive methane exemptions *(Expected 2014)*		
(I-3) GHG Leak Reduction from Oil and Gas Transmission- Best Management Practices and technologies to reduce fugitive emissions from venting and leaks along natural gas pipelines practices *(under evaluation)*	No adverse environmental impact anticipated, but additional analysis will verify.	Separate environmental evaluation will be conducted during regulatory development.
(I-4) Refinery Flare Recovery System Improvement *(Equivalent measure implemented by local air districts)*	No adverse environmental impact anticipated, but additional analysis will verify.	Separate environmental evaluation will be conducted during regulatory development.
(I-5) Removal of Methane Exemption from Existing Refinery Regulations *(Under evaluation in collaboration with local air districts)*	No adverse environmental impact anticipated, but additional analysis will verify.	Separate environmental evaluation will be conducted during regulatory development.

After adoption of the initial Scoping Plan, the following programs were developed and implemented in furtherance of the measures identified above in Table 5. As part of adoption of these programs, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate.

1. Energy Efficiency and Co-Benefits Audits for Large Industrial Sources

The initial Scoping Plan included a measure that would require California's largest industrial facilities to conduct a one-time assessment of the facility's fuel and energy consumption and emissions of GHGs, CAPs, and TACs. The assessments were to include the identification of potential energy efficiency improvement projects. ARB approved the energy efficiency assessment regulation in 2010 and subsequently received assessment reports from 43 industrial facilities covering five industrial sectors: refinery, cement, hydrogen production, power generation, and oil and gas/mineral production. These are facilities that are covered entities under the Cap-and-Trade Program. The first of the Public Reports was posted on June 6, 2013 and the second on August 26, 2013. Links to the reports are available at: http://www.arb.ca.gov/cc/energyaudits/energyaudits.htm . After the release of all the Public Reports, ARB will develop preliminary findings and recommendations for all of the sectors. ARB will use these findings to identify the best approaches to secure energy efficiency improvements and the associated emission reductions at California's largest facilities (ARB 2013a).

2. Oil and Gas Extraction GHG Emission Reduction

The initial Scoping Plan proposed the development of a measure to reduce venting and fugitive GHG emissions associated with oil and gas production. These emissions come from various sources, such as compressor seals, storage tanks, and leaking components such as valves, flanges, and connectors. The results of a survey conducted by ARB of the oil and gas industry were released in 2011, and ARB staff released a new test procedure for determining emissions from oil and natural gas separation and storage systems in 2012 (ARB 2013b).

3. GHG Emissions Reduction from Natural Gas Transmission and Distribution

In 2009, ARB conducted a survey of emissions from commercial, residential, and industrial natural gas transmission and distribution pipelines. This survey assessed fugitive GHG emissions from these pipelines based upon material types including: plastic, copper, caste iron, protect steel, and unprotected steel. In addition, other pipeline components were assessed, such as household and commercial meters, metering and regulation stations, and compressors (ARB 2009b).

6.0 CAP-AND-TRADE REGULATION

A. 2008 Scoping Plan Overview

The initial Scoping Plan recommended the development of a California Cap-and-Trade Regulation that links with other Western Climate Initiative partner programs to create a regional market system. On January 1, 2013, ARB launched the second-largest GHG Cap-and-Trade Program in the world. The Cap-and-Trade Regulation ensures progress toward the near-term 2020 statewide limit, while providing businesses the greatest flexibility to reduce emissions at the lowest possible cost.

The Cap-and-Trade Program is a vital component in achieving both California's near- and long-term GHG emissions targets. California's Cap-and-Trade Regulation is purposely designed to leverage the power of the market in pursuit of an environmental goal. It opens the door for major investment in emission-reducing technologies and sends a clear economic signal that these investments will be rewarded. The Cap-and-Trade Regulation establishes a hard and declining cap on approximately 85 percent of total statewide GHG emissions. Under the Cap-and-Trade Regulation, ARB issues allowances equal to the total amount of allowable emissions over a given compliance period and distributes these to regulated entities. One allowance equals one metric ton of greenhouse gases. Each regulated entity must hold allowances or other compliance instruments equal to its emissions.

The Cap-and-Trade Regulation is being implemented in two stages. Electric generating utilities, electricity importers, and large industrial facilities became subject to the program beginning in 2013, and fuel distributors are brought under the cap in 2015.

Under the Cap-and-Trade Regulation, a portion of the allowances required for compliance are auctioned by the State. The first auction of emission allowances occurred in November 2012. To date, ARB has held six successful auctions.

ARB is considering several amendments to improve the Cap-and-Trade Regulation. In particular, ARB proposes to provide additional transition assistance in the form of free allowances to industrial producers while the new leakage studies are being conducted. In addition, ARB is proposing mechanisms to keep allowance prices within an acceptable range by allowing a limited number of future allowances to be used for compliance should prices get too high. California linked its program with the Canadian Province of Québec in January 2014. California and Québec have worked together to harmonize their regulations and coordinate on a joint auction platform and tracking system. ARB provided a report on the status of linkage implementation to the governor and Cal/EPA in November 2013.

As part of the Cap-and-Trade Regulation, the Board also approved an Adaptive Management Plan to monitor for unintended consequences of the Cap-and-Trade Regulation. The Plan requires ARB to develop systems to monitor for and respond to: (1) potential adverse localized air quality impacts that might be caused by the Cap-

and-Trade Regulation, and (2) potential adverse impacts that might be caused by the Compliance Offset Protocol U.S. Forest Projects (Protocol). ARB is working with the local air districts to determine the most effective path forward for gathering and evaluating permit data, GHG data, and other information needed for monitoring for potential localized impacts. As part of this effort, ARB staff has proposed amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions to collect information on GHG emission increases and decreases from covered entities. ARB has contracted with the University of California, Davis, and is working with forestry experts from around the country to develop a proposed monitoring approach to understand potential forest impacts resulting from implementation of the Protocol under Cap-and- Trade.

B. Summary of Prior Environmental Impact Analysis

In 2010, ARB prepared an environmental analysis, entitled the *Functional Equivalent Document prepared for the California Cap on GHG Emissions and Market-Based Compliance Mechanisms* (2010 Cap-and-Trade FED), to analyze the environmental impacts associated with the proposed Cap-and-Trade Regulation and the four proposed compliance offset protocols. The FED concluded that the compliance responses to the proposed Regulation would result in beneficial impacts to air quality through reductions in emissions, including GHGs, CAPs and TACs, in addition to beneficial impacts to energy demand. It further concluded that the Regulation would result in less than significant impacts, or no impacts, to aesthetics, agricultural and forest resources, hazards, land use, noise, employment, population and housing, public services, recreation, transportation and traffic, and utilities/service systems. The FED concluded there could be potentially significant adverse impacts to biological resources, cultural resources, geology/soils and minerals, and hydrology/water quality largely due to construction activities for projects to reduce GHG emissions. Although the potential for adverse impacts caused by implementation of projects under Forest Offset Protocol and adverse localized air quality impacts were found to be unlikely, the FED conservatively considered them potentially significant. The Board approved an Adaptive Management Plan as an integral part of the program to monitor and address any unanticipated and unintended adverse impacts to localized air quality or biological resources from the Cap-and-Trade Regulation (see description above). The final Regulation was adopted in October 2011 and became effective on January 1, 2012 (ARB 2011b).

In 2012, ARB proposed two sets of amendments to the Cap-and-Trade Regulation. The first set of amendments, related to program implementation, was approved by the Board in June 2012. The second set of amendments, related to jurisdictional linkage with Québec, was approved by the Board in April 2013. An environmental analysis (2012 Cap-and-Trade EA) prepared for these amendments was included in Chapter IV of the Staff Report: Initial Statement of Reasons entitled *Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions (*ARB 2012a).

The 2012 Cap-and-Trade EA concluded that the amendments to clarify the Cap-and-Trade Regulation to help ARB implement, oversee, and enforce the Regulation would not change what was already required or the methods of compliance by covered entities evaluated in the 2010 FED (i.e., upgrade equipment, decarbonize, implement process changes, and surrender compliance instruments), and therefore the potential for environmental impacts fell within the scope and scale of those already analyzed. The analysis also considered the potential for indirect environmental impacts resulting from California-covered entities acquiring offset credits from projects in Québec because implementation of the linkage amendments could result in California entities acquiring credits from offset projects under Québec's Digesters (i.e., livestock), ODS, and Landfill Gas Offset Protocols. The EA relied on the prior EA conducted for California's ODS and Livestock Offset Protocols and ARB's Landfills Regulation because Québec's protocols are substantially similar. Those prior EAs concluded that implementation of these types of offset projects would result in beneficial impacts to GHG emissions and no adverse impacts, or less-than-significant impacts, in all resource areas, except implementation of the Livestock Protocol has the potential for significant adverse impacts to odors, cultural resources, noise, and transportation/traffic. The analysis referenced recognized mitigation measures for these impacts and determined that these impacts can be avoided or reduced to a less-than-significant level. However, because the authority to determine project-level impacts and require project-level mitigation lies with the permitting agency for individual projects, in this case Québec agencies, and there is inherent uncertainty in the degree of mitigation ultimately implemented, the analysis took a conservative approach in its post-mitigation significance conclusions finding that impacts to odors, cultural resources, and transportation/traffic in Québec may remain significant after mitigation.

The Board approved written responses to comments on the 2012 Cap-and-Trade EA and adopted findings for the significant adverse impacts. The written response to comments for the first set of amendments are included in the FSOR released in July 2012 (ARB 2012b) and for the linkage amendments in the FSOR released May 2013 (ARB 2013c). These documents can be found on the Cap-and-Trade Regulation website, http://www.arb.ca.gov/regact/2012/capandtrade12/capandtrade12.htm.

In 2013, ARB prepared an EA for the proposed regulatory amendments released in September 2013. The 2013 Cap-and-Trade EA supplements the 2010 Cap-and-Trade FED and was included in Chapter 3 of the Initial Statement of Reasons (ISOR) prepared for the proposed regulatory amendments. It was released for a 45-day comment period from September 9, 2013 to October 24, 2013. The 2013 analysis concluded that the proposed regulatory amendments to the Cap-and-Trade Regulation would not result in any new significant adverse impacts or an increase in the severity of any significant impacts on the environment as previously identified in the 2010 Cap-and-Trade FED and may provide air emissions benefits as compared to current practices. An environmental analysis for the proposed addition of a new Compliance Offset Protocol for Mine Methane Capture (MMC Protocol) was included in the separate Staff Report prepared for the proposed protocol, included as Appendix A to the ISOR prepared for the proposed 2013 regulatory amendments. ARB staff determined that implementation

of MMC projects would result in no adverse impacts to greenhouse gas emissions and public services. Less-than-significant impacts were identified for aesthetics, agriculture and forest resources, air quality, energy demand, geology, soils, and minerals, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, population and housing, recreation, transportation and traffic, and utilities and service systems. Impacts to biological resources and cultural resources were determined to be potentially significant related to landscape disturbance required for construction of facilities and infrastructure. This regulatory proposal is still under development and will be considered for approval by the Board at a public hearing in the spring of 2014.

7.0 RECYCLING AND WASTE MANAGEMENT SECTOR

A. 2008 Scoping Plan Overview

The Recycling and Waste Management Sector covers all aspects of solid waste and materials management, including landfills (recycling, reuse, and remanufacturing of recovered material), composting (anaerobic/aerobic digestion), municipal solid waste (MSW), biomass combustion, and landfilling. This sector also includes market development programs, such as the State's environmentally preferable and recycling-content product purchasing program. The primary source of GHG emissions from this sector is the direct emission of methane from the decomposition of organic material in landfills. This sector contributed approximately 2 percent of total statewide emissions in 2011. It is important to note that, in addition to reducing methane emissions from landfilled waste, recycling and reduction of waste will also reduce upstream GHG emissions associated with producing and transporting products. Although many of these upstream GHG emissions happen outside of California, California's waste policies can help reduce global GHG emissions. In California, regulations have been adopted to reduce emissions from the waste sector by 2 MMT. Mechanisms are being explored that can provide even greater GHG emission reductions.

The initial Scoping Plan identified several activities that would continue to move California forward in enhancing this integrated system for addressing waste-related issues and further reduce GHG emissions from this sector. These activities include landfill methane emission reductions, reduction in waste generation, and shifting waste to more beneficial uses. To achieve the greater level of recycling now required by AB 341, multiple alternative pathways for waste processing will need to occur. These pathways include: enhanced recycling/reuse/remanufacturing, composting and anaerobic digestion, and traditional biomass conversion.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the recycling and waste management sector measures is provided in Table 6. More details about measures that have been implemented since 2008, and a summary of their associated environmental analyses, follow this table.

Table 6 Summary of Recycling and Waste Management Sector Environmental Impacts in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(RW-1) Landfill Methane Control *(June 2009, early action item)*	**Air Quality** – Installation of control devices such as flares and energy recovery systems may slightly increase NO_X and CO. Water Resources - NO_X may be scrubbed out of the air and deposited into open water, adversely impacting water quality.	Include NO_X and CO in air district's emission inventory. Obtain offsets if landfill gas to energy project. Gas collection systems with flares or other combustion devices are currently the best means to reduce methane. Not quantified at this time. Use of BACT, collection systems would reduce impact.
(RW-2) Additional Reductions in Landfill Methane: Increasing the Efficiency of Landfill Methane Capture *(Ongoing)*	No adverse environmental impact – preparation of a Best Practices Guidance document.	None necessary.
(RW-3) High Recycling/ Zero Waste *(Adopted by CalRecycle January 2012; some strategies are ongoing)*	**Air Quality** – Composting facilities may emit VOCs and NO_X, which are criteria pollutants that contribute to ozone formation. Anaerobic digesters may emit air pollutants. **Water Resources** – Compost operations may adversely impact water quality if waste is discharged to the waters of the State.	Site- and project-specific analysis necessary for new facilities. Compliance with Permit to Construct from air district. Use of BACT. Application of a finished compost blanket would reduce VOC emissions for compost operations. Site- and project-specific analysis necessary for new facilities. Compliance with Permit to Construct from air district. Use of BACT. Compliance with waste discharge requirements.

After adoption of the initial Scoping Plan, the following programs were developed and implemented in furtherance of the measures identified above in Table 6. As part of

adoption of these programs, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate.

1. Landfill Methane Control

In June 2007, the Board identified a measure to reduce methane emissions from MSW landfills as a discrete early action measure. This proposed regulation was developed to implement this early action measure. The proposed regulation was developed in close collaboration with California Integrated Waste Management Board (CIWMB) staff.

The regulation requires owners and operators of certain smaller and other uncontrolled landfills to install gas collection and control systems. The regulation also includes requirements to ensure that existing and newly installed gas collection and control systems are operating optimally. At the time the regulation was being developed, there were about 367 landfills in ARB's landfill emissions inventory with the potential to generate methane emissions. Of these, 218 landfills (14 of which are uncontrolled) were expected to be subject to the proposed regulation.

As part of the EA prepared for this regulation, staff found no significant adverse impacts. Staff also found that reducing methane emissions would have a beneficial impact on climate change and would further reduce emissions of toxic compounds and ozone precursors that are also present in landfill gas (ARB 2010c).

The Landfill Methane Control measure was approved in June 2010.

8.0 FORESTS SECTOR

A. 2008 Scoping Plan Overview

California has a vast forest land base covering approximately 33 million acres, or roughly a third of the state. Approximately 60 percent of California's forests are on federal land, while about 40 percent of them are privately owned. Forests play a critical role in the State's carbon balance. Forests have the ability to remove CO_2 from the atmosphere and store or sequester it long-term as carbon in woody biomass and other plant material. Through conservation and management efforts, atmospheric removal of carbon through sequestration can be greater than the atmospheric emissions from processes such as fire, decomposition of wood, or harvest.

The State's forests also include urban trees. Trees in urban environments, or "urban forests," not only sequester CO_2, but also provide significant shading and other cooling benefits that reduce urban temperatures and energy needs.

The Scoping Plan included a Sustainable Forest Target. The goal of this Target was to maintain the current net forest sink. This could be achieved using the mechanisms provided by the Forest Practice Rules, timberland conversion regulations, fire safety

requirements, and forest improvement assistance programs, as well as CEQA, which requires avoidance or mitigation of forest carbon losses to conversion.

The Plan also identified other opportunities to realize additional net carbon uptake by trees, including:

- Preventing the conversion of forestlands through publicly and privately funded land acquisitions.
- Maintaining and enhancing forest stocks on timberlands through forest management practices subject to the Forest Practice Act.
- Planting trees on lands that were previously covered with native forests.
- Establishing forest areas where the preceding vegetation was not forest.
- Planting trees in urban areas.
- Using urban forest wood waste for biopower.
- Reducing vegetative fuels that could feed wildfires and using this waste for biopower.

The Board of Forestry and Fire Protection (BoF) has been evaluating the adequacy of existing forest regulations and programs for achieving GHG emission reductions and ensuring carbon sequestration in the forest sector. In 2010, amendments to CEQA guidelines led to the requirement that timber harvest proponents subject to State regulations must analyze GHG emissions when applying for CAL FIRE permits.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the forest sector measures is provided in Table 7.

Table 7 Summary of Environmental Impacts the Forest Sector in the 2008 FED

Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(F-1) Sustainable Forest Target *(Ongoing)*	No significant adverse environmental impacts identified.	Project – level compliance with CEQA or NEPA would be accomplished by appropriate lead agencies.
Implementing Strategies: Forest Conservation, Forest Management, Afforestation/ Reforestation, Urban Forestry, and Fuels Management (Under Evaluation)	No significant adverse environmental impacts identified at this time.	Project – level compliance with CEQA or NEPA would be accomplished by appropriate lead agencies. Each of the strategies that have ground disturbing activities is an independent action and must be considered as such. Some activities will meet the definition

Table 7 Summary of Environmental Impacts the Forest Sector in the 2008 FED		
Measure ***(Status/ Consideration Date)***	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(Ongoing)		of a "project" under CEQA, while others will not be subject to CEQA. Projects taking place on federal lands are subject to NEPA.

9.0 HIGH GLOBAL WARMING POTENTIAL GASES SECTOR

A. 2008 Scoping Plan Overview

The concept of Global Warming Potential (GWP) was developed to compare the ability of each greenhouse gas (GHG) to trap heat in the atmosphere relative to another gas. The GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to that of one equivalent unit mass of carbon dioxide (CO_2) over a specified time period. CO_2 has a GWP of 1. Methane (CH_4), however, has a GWP of 72, which is 72 times higher than CO_2. There are four major groups or types of high GWP gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). The GWP values for high GWP gases can be hundreds to over ten thousand times higher than CO_2. High GWP gases are released primarily in two ways. The first is through leaking systems, and the second is during the disposal process. Once high GWP materials are released, they persist in the atmosphere for tens or even thousands of years.

The majority of high GWP emissions in California consist of HFCs. While they currently account for three percent of California's statewide GHG emissions inventory, concentrations are expected to increase in California due to the replacement of ozone depleting substances (ODS) in response to the Montreal Protocol mandates[4]. HFCs are a human-made chemical, and may be generally defined as compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as an alternative to chlorofluorocarbons (i.e., an ODS) in foam production, refrigeration, air conditioning

4 In September 1987, efforts to negotiate binding obligations to reduce the use of ODS led to the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer. HFCs are intentionally made fluorinated GHGs used as replacements for ozone-depleting substances. The United States, Canada, and Mexico together submitted a proposal to phase-down consumption and production of hydrofluorocarbons (HFCs) under the Montreal Protocol on Substances that Deplete the Ozone Layer in April 2013. On June 8, 2013, the United States and China entered into a preliminary agreement to phase down the production and consumption of HFCs between the two countries. Details of the phase-down schedules are under development.

systems, fire suppression systems, and the production of insulating foam. They do not significantly deplete the stratospheric ozone layer, but they are powerful GHGs with GWPs ranging from 140 (HFC-152a) to 11,700 (HFC-23).

The focus of the initial Scoping Plan measures associated with high GWP gases was primarily related to HFC emission reduction programs. These measures focused on two central themes to achieve 6.5 MMT of GHG emission reductions in 2020: (1) use lower-GWP alternatives for certain consumer products and new motor vehicle AC systems, and (2) avoid the release of high-GWP gases from such sources as electrical transmission equipment and particle accelerators, by using gas recovery options and leak tightness specifications.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the high GWP gases sector measures is provided in Table 8. More details about measures that have been implemented since 2008, and a summary of their associated environmental analyses, follow this table.

Table 8 Summary of High GWP Sector Environmental Impacts in the 2008 FED

Measure *(Status/Consideration Date)*		**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
H-1	Motor Vehicle Air-Conditioning Systems: Reduction of Refrigerant Emissions from Non-Professional Servicing *(January 2009, early action item)*	No adverse environmental impacts.	None necessary.
H-2	SF_6 Limits in Non-Utility and Non-Semiconductor Applications *(February 2009, early action item)*	**Hazards and Hazardous Materials** – If N_2O were used in place of SF_6 for fume hood tests, a potential exposure could occur if N_2O was accidentally released. Impacts to vulnerable populations should be considered. **Energy Demand** – SF_6 tracer tests for fume hoods are required by CAL/OSHA with a specific energy efficient technology. If ARB's regulation did not allow this test, some energy conservation efforts for fume	Ensure proper ventilation at exhaust stacks and ensure only verifiers are in the testing room. An exemption for this use or a change in the required test/standard would eliminate any impact to energy

Table 8 Summary of High GWP Sector Environmental Impacts in the 2008 FED			
Measure *(Status/Consideration Date)*		**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
		hood may not take place.	conservation efforts.
H-3	Reduction of Perfluorocarbons in Semiconductor Manufacturing *(February 2009, early action item)*	**Energy Demand** – Facilities operate continuously. Compliance achieved with additional abatement equipment could increase peak and off-peak natural gas and /or electricity use as thermal destruction of emissions requires high temperatures.	Purchases of highly energy efficient abatement equipment, purchases of catalytic destruction systems which operate at lower temperatures.
H-4	Limit Use of Compounds with High Global Warming Potentials in Consumer Products *(June 2008, early action item)*	**Air Quality** – Hydrocarbon propellants (butane, propane, isobutane) may have lower GWPs, but may contribute to the formation of ground-level ozone.	ARB to further evaluate employment of reformulation options.
H-5	High GWP Reductions from Mobile Sources *(Part of Advanced Clean Cars program; some measures not feasible at this time)*	No adverse environmental impacts known at this time, however, any alternatives will be subject to approval under US EPA's SNAP to ensure their safety. **Public Health and Safety** - It is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace.	Separate environmental evaluation will be prepared when regulation is developed. Additional technician training.
H-6	High GWP Reductions from Stationary Sources *(February 2010; some measures not feasible at this time)*	**Air Quality** – Potential CAPs and TACs from recovered foams if combusted. Though any alternatives will be subject to approval under US EPA's SNAP to ensure their safety, it is possible that certain alternatives that industry selects may have a higher flammability index than the substances they replace.	Separate environmental evaluation will be prepared when regulation is developed.

Table 8 Summary of High GWP Sector Environmental Impacts in the 2008 FED			
Measure *(Status/Consideration Date)*		**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
		Energy Demand – Facilities operate continuously. Compliance achieved with additional abatement equipment could increase peak and off-peak natural gas and /or electricity use as thermal destruction of emissions requires high temperatures.	Purchase and employment of highly energy efficient abatement equipment, and catalytic destruction systems which operate at lower temperatures.
H-7	Mitigation Fee on High GWP Gases *(Measure not feasible at this time)*	No adverse environmental impact anticipated.	None necessary.

After adoption of the initial Scoping Plan, the following programs were developed and implemented in furtherance of the measures in Table 8 above. As part of adoption of these programs, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate.

1. Advanced Clean Cars Program

As described above under the description of the Transportation Sector, California's Advanced Clean Cars program was approved by ARB in 2012, the EA of which was appended to the program text as Appendix B. The EA discusses both beneficial and adverse impacts on the environment as a result of the projected compliance responses to the proposed regulatory amendments, such as changes in State's vehicle fleet mix, use of different technologies, construction of fuel outlets and relevant manufacturing facilities, and resultant reductions in pollutant emissions. Among the range of environmental issues addressed in the EA, potentially significant and unavoidable environmental impacts were described for the following resources areas: aesthetics, biology, cultural resources, geology and soils, hazards (accidental releases), hydrology and water quality, noise, traffic (construction), and utilities. Less-than-significant environmental impacts were noted in regards to: agriculture and forest resources, land use and planning, mineral resources, population and housing, and recreation. Substantial beneficial environmental impacts, related to air quality and GHG emissions, would result from implementation of a new High GWP Program (ARB 2011a).

2. Sulfur Hexafluoride Leak Reduction Gas Insulated Switchgear

The SF_6 Leak Reduction Program for Gas Insulated Switchgear (GIS) was approved by ARB in 2010. The adopted regulations are expected to reduce 253,000 $MTCO_2$ over the 10-year regulatory period. Parties affected by the proposed regulation are required to have no more than a 10 percent SF_6 emission rate for their GIS equipment and to continue to reduce this annual emission rate by one percent per year beginning in 2011. Specific methods to attain these reductions are not set out in the adopted regulation. Rather, affected entities may determine which methods they will employ to meet the requirements.

The potential environmental impacts were described within the EA prepared within the Initial Statement of Reasons (ISOR) documents. ARB concluded that no significant adverse environmental or employee health impacts should occur from adoption of, and compliance with, the proposed regulation. An additional benefit of this emission reduction measure is a possible reduction in employee exposure to SF_6 toxic byproducts. Because the proposed regulation reduces only greenhouse gas emissions by improving SF_6 management practices, it is not expected to result in any significant adverse air quality, wastewater, or hazardous waste impacts. Consequently, no mitigation measures were recommended (ARB 2010d).

10.0 AGRICULTURAL SECTOR

A. 2008 Scoping Plan Overview

The agricultural sector includes on-site emissions from farm animals, equipment, crop production, and agricultural management practices. Emission sources in the agriculture sector include enteric fermentation (primarily belching by an animal), manure management, rice cultivation, energy use (including fuel combustion), crop residue burning, and soil management practices (fertilizer and manure applications). In 2011, agricultural sources accounted for about 7 percent of California's total GHG emissions.

However, the agricultural sector also is a carbon sink, whereby plants absorb CO_2 through photosynthesis, much of which is stored in plant matter and soils.

California's agricultural sector presents unique challenges to controlling GHG emissions due to its wide diversity of crop and livestock production across the state. The initial Scoping Plan considered voluntary steps to reduce GHG emissions in the agricultural sector in place of regulatory measures, due primarily to costs and scientific uncertainty in measuring GHG emissions in many agricultural systems.

The initial Scoping Plan identified a number of other potential GHG emission reduction activities in this sector, including improving agriculture water use efficiency, increasing the efficiency of or electrifying agricultural water pumps, using biomass-based fuels, and increasing carbon sequestration on agricultural lands.

B. Summary of Prior Environmental Impact Analysis

A summary of the environmental impacts associated with the agricultural sector measures is provided in Table 9. More details about measures that have been implemented since 2008, and a summary of their associated environmental analyses, follow this table.

Table 9 Summary of Agricultural Sector Environmental Impacts in the 2008 FED

Measure *(Status / Consideration Date)*	**Potential Adverse Environmental Impacts**	**Potential Mitigation Measures**
(A-1) Methane Capture at Large Dairies	**Air Quality** – The combustion of biogas in an engine to generate electricity can emit NO_X.	Controls can reduce NO_X in exhaust gasses, but types and sizes of engines typically used in conjunction with a dairy digester may be unavailable, or able to meet air district NO_X requirements. Use of BACT.
	Agricultural Resources – The siting of manure digesters may not be compatible with existing Williamson Act contracts.	Check with city or county to ensure compatibility.
	Biological Resources – construction activities of digester facility may impact biological resources.	Digesters will require CEQA compliance to obtain an "Authority to Construct" permit from the air district. Site specific analysis is necessary to determine whether an impact would result.
Fertilizer Use Efficiency	No adverse environmental impact anticipated	None necessary.
Efficiency Improvements	No adverse environmental impact anticipated	None necessary.

After adoption of the initial Scoping Plan, the following program was developed to implement the measures identified in Table 9 above. As part of adoption of these programs, potential environmental impacts were analyzed and disclosed, and mitigation measures were recommended, as appropriate.

1. Methane Capture at Large Dairies

Methane Capture at Large Dairies as described in the Compliance Offset Protocol Livestock Projects provides methods to quantify and report GHG emission reductions associated with the installation of a biogas control system (BCS) for manure management on dairy cattle and swine farms. The protocol focuses on quantifying the

change in methane emissions, but also accounts for effects on carbon dioxide emissions.

Offset Project Operators or Authorized Project Designees that install manure biogas capture and destruction technologies use the methods contained in this protocol to quantify and report GHG emissions. The protocol provides eligibility rules, methods to quantify GHG emission reductions, offset project-monitoring instructions, and procedures for preparing Offset Project Data Reports. Additionally, all offset projects must submit to annual, independent verification by ARB-accredited verification bodies. Requirements for verification bodies to verify Offset Project Data Reports are provided in the Cap-and-Trade Regulation.

Impacts associated with the Livestock Offset Protocol are described in the 2010 Cap-and-Trade Regulation FED. The FED concluded that protocol implementation would result in less-than-significant impacts to aesthetics, agricultural resources, air quality, biological resources, energy demand, geology, soils, and minerals, GHG emissions, hazards and hazardous materials, hydrology and water quality, land use and planning, employment, population, and housing, public services, recreation, and utilities and service systems. Significant and unavoidable impacts could be associated with odors, cultural resources, noise, and transportation and traffic. As described above, under the Cap-and-Trade Sector discussion, this protocol was adopted as part of the Cap-and-Trade Regulation in October 2011 and became effective on January 1, 2012 (ARB 2011b).

Responses to Comments

on the

Draft Environmental Analysis

for the

First Update to the Climate Change Scoping Plan

California Environmental Protection Agency
AIR RESOURCES BOARD

Released May 15, 2014

to be considered at the

May 22, 2014 Board Hearing

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PREFACE

The California Air Resources Board (ARB) released a Draft Environmental Analysis (EA) for the proposed First Update to the Climate Change Scoping Plan (Update) on March 14, 2014 for a 45-day public review and comment period that concluded April 28, 2014. A total of 118 comment letters were received during the public comment period, seven (7) of which addressed the Draft EA.

ARB staff made minor modifications to the EA based on responses to comments and other updates. To facilitate identifying modifications to the document, modified text is presented in the final EA with strike-through for deletions and underline for additions. None of the modifications alter any of the conclusions reached in the EA or provide new information of substantial importance relative to the EA. As a result, these minor revisions do not require recirculation of the document pursuant to the California Environmental Quality Act (CEQA) Guidelines, California Code of Regulations, title 14, section 15088.5, before consideration by the Board.

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1.0 INTRODUCTION

The California Air Resources Board (ARB) staff prepared and circulated for public review a Draft Environmental Analysis (EA) for the proposed First Update to the Climate Change Scoping Plan (Update). The Update was released for public review on February 10, 2014, and the EA, along with other appendices to the Update, were released for public review on March 14, 2014. The public comment period for all documents concluded on April 28, 2014.

ARB received numerous comment letters through the two comment dockets opened for the Update and EA during that time. The comment dockets are available on the ARB website at: http://www.arb.ca.gov/lispub/comm2/bccommlog.php?listname=draft-update-sp-ws. Pursuant to ARB's certified regulatory program, staff carefully reviewed all the comment letters received by the close of the comment period to determine which raised significant environmental issues related to the EA requiring a written response.

This document presents those comments and ARB's written responses for the Board to consider for approval prior to taking final action on the Update. Although this document includes written response only to those comments related to the EA, all of the public comments were considered by staff and provided to the Board members for their consideration. For reference purposes, this document includes the main body of each comment letter received on the EA before the written response. Attachments and appendices to these comment letters can be found at the link provided above.

Following consideration of the comments received on the EA and during the preparation of the responses to those comments, ARB revised the EA to prepare the Final EA released May 15, 2014 and presented as Appendix F to final version of the Update.

A. Requirements for Responses to Comments

These written responses to public comments on the EA are prepared in accordance with ARB's certified regulatory program to comply with the California Environmental Quality Act (CEQA). ARB's certified regulations states:

> *California Code of Regulations, title 17 section 60007. Response to Environmental Assessment*
>
> *(a) If comments are received during the evaluation process which raise significant environmental issues associated with the proposed action, the staff shall summarize and respond to the comments either orally or in a supplemental written report. Prior to taking final action on any proposal which significant environmental issues have been raised, the decision maker shall approve a written response to each such issue.*

Public Resources Code section 21091 also provides direction regarding the consideration and response to public comments in CEQA. While the provisions refer to

environmental impact reports, proposed negative declarations, and mitigated negative declarations, rather than an EA, this section of CEQA contains useful guidance for preparation of a thorough and meaningful response to comments.

Public Resources Code section 21091, subdivision (d) states:

> *(1) The lead agency shall consider comments it receives … if those comments are received within the public review period.*
>
> *(2) (A) With respect to the consideration of comments received …, the lead agency shall evaluate comments on environmental issues that are received from persons who have reviewed the draft and shall prepare a written response pursuant to subparagraph (B). The lead agency may also respond to comments that are received after the close of the public review period.*
>
> *(B) The written response shall describe the disposition of each significant environmental issue that is raised by commenters. The responses shall be prepared consistent with section 15088 of Title 14 of the California Code of Regulations, as those regulations existed on June 1, 1993.*

California Code of Regulations, title 14, section 15088 (CEQA Guidelines) also include useful information and guidance for the preparation of a thorough and meaningful response to comments. It states, in relevant part, that specific comments and suggestions about the environmental analysis that are at variance from the lead agency's position must be addressed in detail with reasons why specific comments and suggestions were not accepted. Responses must reflect a good faith, reasoned analysis of the comments.

> *California Code of Regulations, title 14, section 15088 (a – c) states:*
>
> *(a) The lead agency shall evaluate comments on environmental issues received from persons who reviewed the draft EIR and shall prepare a written response. The Lead Agency shall respond to comments received during the noticed comment period and any extensions and may respond to late comments.*
>
> *(b) The lead agency shall provide a written proposed response to a public agency on comments made by that public agency at least 10 days prior to certifying an environmental impact report.*
>
> *(c) The written response shall describe the disposition of significant environmental issues raised (e.g., revisions to the proposed project to mitigate anticipated impacts or objections). In particular, the major environmental issues raised when the Lead Agency's position is at variance with recommendations and objections raised in the comments must be addressed in detail giving reasons why specific comments and suggestions were not accepted. There must be good faith, reasoned analysis in response. Conclusory statements unsupported by factual information will not suffice.*

B. Comments Requiring Substantive Responses

Staff is required to prepare substantive responses only to those comments that raise "significant environmental issues" associated with the proposed action as required by California Code of Regulations, title 17, section 60007(a). As stated above, of the total 118 comment letters submitted on the two comment dockets open until April 28, 2014, staff determined that seven (7) mentioned or raised an issue related to the EA or an environmental issue related to the Update addressed in the EA. Staff was conservatively inclusive in determining which letters warranted a written response. Although the other comment letters received are not responded to in writing, those comments were considered by staff and provided to the Board members for their consideration.

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2.0 RESPONSES TO COMMENTS

ARB received seven (7) comment letters that mentioned or raised an issue related to the EA or an environmental issue related to the Update addressed in the EA. Table 2-1 identifies the commenters that submitted those comment letters and commenter information. The full comments letters are reproduced here in their entirety even if only a portion of the letter raised an EA related comment. In addition, some comment letters were blocked entirely as one comment and only those portions of the blocked comment that related to the EA, or where ARB chose to provide clarifying text, were responded to accordingly. It is ARB's intent to indicate that the entire comment, related to the EA or not, was considered in those cases.

Table 2-1. List of Commenters

Comment Number	Commenter	Affiliation
1	Tom Frantz	
2	Harvey Eder	Solar Power Coalition
3	Joyce Dillard	
4	Michael Bullock	
5	Kevin Bundy	Center for Biological Diversity
6	Ed Pike	Energy Solutions
7	Catherine H. Reheis-Boyd	Western States Petroleum Association

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Letter 1

AB32 EJAC 2013 Biomass Issues
Tom Frantz, EJAC member

Biomass Incinerators in the San Joaquin Valley and concerns with the Adaptive Management Plan

Background:

There are more than 20 biomass incinerators in the San Joaquin Valley and the number has been growing. These incinerators have a fuel capacity of over 4 million tons of biomass. Statewide there are enough biomass incinerators for another million or two tons of fuel. Agricultural sourced biomass has never reached 1 million tons in the San Joaquin Valley and probably never will. Therefore, approximately 80% of the biomass fuel potentially incinerated in the SJV has to be trucked from the large urban areas in the state in order to keep these facilities running. This biomass from the urban areas consists of prunings, demolition timber, broken pallets, etc.

These facilities emit a lot of air pollution relative to the energy they create. They also emit a lot of CO2 relative to their output. Some of their permits from the San Joaquin Valley Air Pollution Control District allow up to 2% plastic by weight in the fuel mix. The trucking of the fuel also emits a lot of pollution.

These facilities are very often located near environmental justice communities. The ones listed in the appendix are all located in the SJV air basin which has the worst air in the nation and the most severe health effects from that pollution. Progress towards federal standards for air quality has been very slow in recent years. A graph is in the appendix showing negative progress at three SJV ozone monitors over the past five years. 1-1

It is believed that a lot of these facilities have contracts to sell renewable energy to help satisfy the Renewable Portfolio Standard for power companies.

The Appendix has a list of these facilities and an analysis of their potential pollution.

Liberty Energy has been permitted by Kern County as a renewable energy gasification plant using sewage sludge and biomass as fuel. Cal-Recycle certified the bubbling fluidized bed boiler as gasification so that the facility would qualify for renewable energy. The San Joaquin Valley Air District permitted the plant as having an ordinary boiler and said it was not gasification. PG&E gave the plant a contract to sell them renewable energy. The sewage sludge will not burn by itself so it needs massive amounts of biomass as extra fuel. The trucking of the biomass and the sewage sludge from Los Angeles County to Kern County (near the low income, largely Hispanic farmworker community of Lost Hills) uses more energy than the plant will provide to the grid. This plant, with the trucking, will produce a tremendous amount of air pollution for Kern County.

This ill conceived method of creating so-called renewable energy should not go forward. CARB should take a roll in reviewing permits and contracts such as this and decide their legitimacy.

More details on Liberty Energy are found in the Appendix below.

Concerns

1. The Adaptive Management Plan should be expanded to include the Renewable Portfolio Standard and the Low Carbon Fuel Standard. This should be done in order to cover all facilities qualifying as renewable energy and/or qualifying under the Renewable Portfolio Standard. Currently, the Adaptive Management Plan is directed at Cap and Trade actions only. http://www.arb.ca.gov/cc/capandtrade/adaptivemanagement/plan.pdf

2. The Adaptive Management Plan needs to be responsive to environmental justice communities. Besides having the Adaptive Management Plan applied to all aspects of the AB32 Scoping Plan there should be outreach to those communities which are already impacted by criteria and toxic emissions from facilities emitting quantities of GHG above a certain defined threshold. Affected communities should be told how AB32 is regulating these facilities and what specific improvements in the local environment may or may not occur because of AB32 implementation. The communities should also be directly asked for their input and suggestions. 1-1 cont'd

3. A lifecycle analysis should be made of the varying situations among biomass incinerators of all types. Some of them may not qualify for the Renewable Portfolio Standard because of the type of fuel being used and/or the energy needed to procure the fuel. This analysis must include alternative uses of the different fuels and land use changes.

4. Alternatives such as well controlled aerobic composting of some of this biomass material should be encouraged with greater incentives than those existing for incineration. Currently, contracts for renewable energy suppliers are a real incentive for incineration of many types of biomass. Applying biomass to the soil is well documented to provide a greater CO2 reduction benefit than incineration for energy (please see the article on biomass incineration in the appendix).

5. The location of the biomass incinerator with respect to the fuel source should be considered. Trucking biomass over 100 miles to a greatly impacted air basin and then incinerating it for renewable energy goes against the specific language of AB32 which says actions to meet AB32 goals should not hinder the progress of a region towards air quality standards. It does not make sense for energy created from biomass fuel which is trucked over 50 miles from where it is collected be considered part of the renewable portfolio standard. There should be real

incentives for biomass incinerators to be located next to collection centers for the fuel such as landfills.

6. The coordination of various agencies permitting biomass facilities needs to be improved. Liberty Energy, mentioned above, is a classic example of where the lack of this coordination seems to have resulted in something that is an abuse of AB32 goals.

Appendix

1-1 cont'd

The table below is a list of the known Biomass facilities whose air pollution has an affect on the San Joaquin Valley. The last two on the list have not been built. Rio Bravo Jasmin and Rio Bravo Poso are still burning coal while they convert to Biomass. It is possible that other plants exist and even more plants have been proprosed and are perhaps being permitted currently. Even some oil companies in Kern County have proposed building several small biomass boilers to make steam for enhanced oil recovery.

Following the table are a few assumptions about how much biomass these facilities can incinerate. Included are the number of truck trips with an estimate of the NOx pollution from this trucking. Also included is an estimate of the NOx and PM emissions from these facilities.

Comment Letter 1 Response

1-1 ARB has reviewed this comment and determined that it does not raise any significant environmental issues associated with the proposed action, the adequacy of the environmental analysis, or alternatives analyzed in the Draft EA prepared for Update. Under CEQA Guidelines (Cal. Code Regs., tit. 14, §15204), reviewers should focus on the sufficiency of the environmental document in identifying and analyzing the possible impacts on the proposed project and ways in which the significant effects might be avoided or mitigated. In accordance with ARB's certified regulatory program (Cal. Code Regs., tit. 17, § 60007, subd.(a)) and the CEQA Guidelines (See Cal. Code Regs., tit. 14, § 15088), no revision or further written response is required in response to this comment.

Nonetheless, staff notes that the concerns raised by the commenter about potential air quality impacts associated with biomass facilities are addressed generally in the Draft EA on pages 75 through 77 relative to the Natural and Working Lands Sector.

In addition to this concern, the commenter also makes several recommendations that staff addresses briefly below even though they do not directly relate the adequacy of the Draft EA.

The commenter suggests that the Adaptive Management Plan be expanded to apply to other aspects of AB 32. ARB is developing a multi-phase proposal to assess the effects (e.g., benefits and potential impacts) of AB 32 programs on disadvantaged communities. The key objective is to introduce a quantitative mechanism to gauge the effectiveness of AB 32 programs with respect to disadvantaged communities. This effort could be integrated with the Cap-and-Trade Adaptive Management process, and ARB aims to present this proposal at public meetings anticipated to be held in 2014. ARB's proposed strategy is now described in Chapter 6, Section C of the final version of the Update posted on May 15, 2014.

The commenter suggests that a lifecycle analysis should be undertaken of the varying situations among biomass incinerator types, including alternatives such as aerobic composting. Staff agrees that conducting a full lifecycle analysis for the treatment of biomass is necessary to capture all the potential benefits and impacts that could occur with its many treatment options including biomass incineration and the use of biomass in aerobic composting. The treatment of biomass crosses different sectors and affects how each of these sectors accounts for the potential greenhouse gas (GHG) reductions. For example, biomass use in the Forest and Natural Lands sector encourages increases in forest biomass through forest management practices and increases in the amount of carbon stored in urban trees by the removal of carbon dioxide (CO_2)

from the atmosphere via photosynthesis. On the other hand, the use of biomass for energy production can be beneficial to meet the demands of renewable energy. Composting also provides GHG benefits by its use in land application and in water savings, fertilizer, and soil stabilization. The Scoping Plan Working Papers in Attachment C provide an analysis of different waste treatment options, including thermal treatment and composting. While not a full lifecycle analysis based on different types of incinerators, the papers provide GHG emissions information and some of the challenges and opportunities with each waste treatment option. The Working Papers can be found here: http://www.arb.ca.gov/cc/scopingplan/2013_update/waste.pdf.

The commenter notes a concern about the over concentration of biomass facilities in the San Joaquin Valley and suggests that the location of biomass incinerators, relative to the fuel sources, should be more comprehensively considered to better avoid adverse pollution impacts from oxides of nitrogen (NO_X) that may result from truck trips generated to transport biomass to biomass incinerators in the San Joaquin Valley. As noted in the Update, the State generally supports further development of biomass facilities to increase renewable energy production and biofuel use for transportation purposes, for purposes of achieving GHG emission reductions. However, in accordance with AB 32, in implementing such policies the State is charged with ensuring that these actions complement the State's efforts to improve air quality. As noted in the Draft EA prepared for the Update, some of the secondary emission sources associated with biomass facility operations typically incudes the transport of biomass feedstock, feedstock processing, water consumption, waste water treatment, and waste handling, and facility construction. As a result, all of these factors (including the concentration of such facilities), should be taken into consideration by the local air district during the permit review stage for a prospective facility. For example, because the San Joaquin Valley Air Pollution Control District currently exceeds ambient air quality standards, the potential for developing additional biomass generating facilities in this district could be constrained.

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Letter 2

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BELOW IS THE COMMENT YOU SELECTED TO DISPLAY.
COMMENT 3 FOR DRAFT ENVIRONMENTAL ANALYSIS FOR SCOPING PLAN UPDATE (DRAFTEASPU14) - NON-REG.

First Name: Harvey
Last Name: Eder
Email Address: harveyederpspc@yahoo.com
Affiliation: Pt 2 Ex Dir Public Solar Power Coalition

Subject: Total CA Solar Conversion by 2023 or in 9 Years HE PSPC SC 119641 Eder v SCAQMD et. al.
Comment:
This is Part 2 of Comments. Part 1 was written on April 25, 2014 and submitted both for Comment 29 For Draft Proposed First Update To The Climate Change Scoping Plan and to The Draft Environmental Analysis Prepared For Proposed First Update To The Climate Change Scoping Plan ...Today is Monday April 28,2014

T^he Environmental Analysis is Illegal and not a sick bird rather a bird...

Solar Energy makes the wind blow the water flow and the plants grow . It is the engine of our ecosystem. It's the way things work.

Solar systems have becomje life cycle cost effective as the costs of systems and interest rates have declined in recent years.

CARB approved on Dec 25,2012 the SCAQMD South Coast Air Quality Management Districts December 2012 Air Quality Management Plan . This is illegal and fattening. Both SCD and CARB asw2ell as San Juaquine District and the Bay Area District as well as the rest of the State must by cinvwerted to ImmediTE tOTAL sOLAR eNERGY BY 2020 AS SOON AS POSSIBLE. wE (THE REGAL WE) HAVE BEEN IN TOUCH WITH epa AND WILL OPPOSE THE 2012 sip ANDSdISTRICTS pLANS tHAT ARE nOT iMMEDIATE tOTAL sOLAR cONVERSION pLANS & iMMPLEMENTATIONS.

In the State of CA Supreme Court Caseof SCAQMD v Coatins Association of 2012 the SCD won and established that BARCT Best Avialble Retrofit Control TechnOology is a technolgy forcing law and while solar is life cycle cost efficitave now it will be more so by 2020 and must be required to be retrofit ed now for buildioing and for processes as well as electric vehicles in the state. 2-1

While the current peak electricity load is apx. 60 GW Gigawatts a total of 180 GW Gigawatte peak will be needed to convwert to solar electric vehicles and hydrogen electric either fuel cells electrolisis ofwater to hydrogen orhydrogen directly which work at from 50-80% efficiency and can store solar energy daily weekly months seasonally or fpor years .

CPUC ordering plus 1 GW of Storage is a modest start but we willneed apxc 180 GW Hours plus toconvert CA.

AB32 and othewr parts of CAlaw require CARB etc to convert to Solar Renewables ASAP by 2020. The law sssays thou shalt implement the best technology that is possible that is cost effective whivch solar is. Incorpoprated herein by reference is State Health and safety code 3800 as well as 40404.5 and 40405 and40406 ie as SCD Solar conversion (immediate) and implementation plan as well as other District and the CA
SI(P StateImplimentation Plan. Distreicts use low nox burners as BACT etc to can use Solar as BARCT BACT etc now. Do it already.

US DOE Department of Energy Sunshot will have solar e;lectricity at 5 cents per KWH by 2020 noquestion do itnow...

http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=drafteaspu14&comment_num=17&virt_num=3[4/29/2014 4:14:30 PM]

Comment Log Display

ITSC using CHP Combined Solar Heatand Colling (absorbtion chillers district heatingand cooling and pv and thermas systems or hybrids are cost effective now (also rember CA Supremes Tech Forcing Colar 5cents by 2020.

PG&E went bankrupt and Comissioner Florio told me that Senator Pro Tem John Burton put together a deal what the state would buy out their T &
D transssssssssssssition and distribution system for $1 but even thought this was a go with a republican governor and was gpo for a few weeks it fvell thought . But they are going BK Gin when the share holders have topay for a minimun fof 250,00 0 year of storage of nuclear waste as well as bankkruptcy for SCE and SDG&E and Sempra Dirty Gas is 80-100 plus temmmmmmes the GWP global warming potential impact compared to CIO2 must6 896dirty gas care and asall heat etd,.etc,. more to come ...

2-1 cont'd

Wolarly HE PSPC 3:11 PM 4/28/14

Attachment:

Original File Name:

Date and Time Comment Was Submitted: 2014-04-28 14:15:55

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

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Comment Letter 2 Response

2-1 Although the commenter submitted several letters, issues related to the EA are limited to part 2 (i.e., the letter provided above). The commenter states that the "The Environmental Analysis is Illegal and not a sick bird rather a bird…"

ARB prepared the Draft EA for the Update in accordance with its certified regulatory program and CEQA. Absent any more specific critique of the adequacy of the EA, staff is unable to provide a more specific response. The other portions of the comment do not relate to the EA and no written response is required by ARB's certified regulatory program under CEQA. Nonetheless, ARB staff notes that the Update encourages the use of renewable energy projects, including solar panels, as described in Section 2, Project Description of the EA.

Letter 3

Comments to ARB EA Update to the AB 32 Scoping Plan due 4.28.2014

Project Description:

> *The Proposed Update builds upon the framework established by the initial Scoping Plan and provides recommendations for the State to achieve its long-term climate objectives beyond 2020. Under the guidance of the Climate Action Team, ARB and other State agencies collaborated during the development of the Proposed Update to identify and describe a long-term vision and near-term recommended actions to put California on the path to its 2050 emission reduction goals.*

and

> *The recommended actions in the Proposed Update have been developed to reduce GHG emissions from key sources and activities,* ***while improving public health, promoting a cleaner environment, preserving natural resources****, and ensuring, to the extent feasible, that the* ***impacts of the reductions are equitable and do not disproportionately affect low-income and minority communities****. The recommended actions are designed to contribute to further GHG emission reductions by 2020 and to continue the State's progress toward meeting the long-term 2050 goal of reducing California's GHG emissions to 80 percent below 1990 levels.*

Project Objectives

3-1

1. *To update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions at least once every five years*
2. *To update the State's Scoping Plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions at least once every five years.*
3. *Pursue measures to maintain and continue reductions in emissions of GHG beyond 2020.*
4. *Pursue measures that implement reduction strategies covering the state's GHG emissions in furtherance of California's mandate to reduce GHG emissions to 1990 levels by 2020.*
5. *Reduce fossil fuel use – to reduce California's reliance on fossil fuels and diversify energy sources while maintaining electric system reliability*
6. *Design an enforceable, amendable program – to design a program that is enforceable and that is capable of being monitored and verified;*
7. *Ensure emission reductions – to pursue emissions reductions that are real, permanent, quantifiable, verifiable and enforceable*

8. *Achieve technologically feasible and cost-effective reductions – to achieve the maximum technologically feasible and cost-effective reductions in GHG emissions, in furtherance of achieving the statewide GHG emissions limit*
9. *Avoid disproportionate impacts – to ensure, to the extent feasible, that activities undertaken to comply with the measures do not disproportionately impact low income communities*
10. *Complement existing air standards – to ensure, to the extent feasible, that activities undertaken pursuant to the measures complement, and do not interfere with, efforts to achieve and maintain national and California Air Quality Attainment Standards and to reduce toxic air contaminant (TAC) emissions*
11. *Consider a broad range of public benefits – to consider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health*
12. *Minimize administrative burden – to minimize, to the extent feasible, the administrative burden of implementing and complying with the measure*
13. *Weigh relative emissions – to consider, to the extent feasible, the contribution of each source or category of sources to statewide emissions of GHGs*
14. *Maximize co-benefits – to maximize, to the extent feasible, additional environmental and economic benefits for California, as appropriate*
15. *Avoid duplication – to ensure that electricity and natural gas providers are not required to meet duplicative or inconsistent regulatory requirements*

3-1 cont'd

Alternatives give no accountability to the following:

> ***. . . improving public health, promoting a cleaner environment, preserving natural resources****, and ensuring, to the extent feasible, that the* ***impacts of the reductions are equitable and do not disproportionately affect low-income and minority communities****.*

We see no mitigation for improving Public Health. We do see a Cap and Trade system of exchange with SB 535 allocations to Disadvantaged Communities or an Investment Justice approach. That is not Public Health.

We see no mitigation for preservation of Natural Resources.

The alternatives are weighted in Transportation outcomes and in Utility delivery. This focus on a Built-Environment does not take into account a Cleaner Environment. We see no Ecosystem approach to encompass Natural Resources or their preservation. California Climate Adaptation Strategy has not yet been adapted to General Plans and their Elements. Effects from the ocean due to natural occurrences or disasters are not yet incorporated into the AB32 Scoping Plan Update. There is no allowance for a surge of effects on the Plan and no alternatives to address an unexpected emission increase instead of reduction.

Earthquakes, high groundwater, surface water, stormwater and urban runoff are factors into the continuity of a Built Environment's vulnerability and potential reversal of the Plan's objectives.
The weak point is Groundwater Management. Non-adjudicated basins are difficult, but adjudicated basins where the rule of law is ignored present more unnecessary challenges.

For instance, the State Water Resources Control Board does not recognize the rule of law in the decision in the California Supreme Court-City of Los Angeles v. City of San Fernando , 14 Cal.3d 199 [L.A. No. 30119. Supreme Court of California. May 12, 1975.]. CITY OF LOS ANGELES surface water rights were awarded to LAUREN BON (Application 32212), ignoring the long standing judgment from January 26, 1979 involving PUEBLO RIGHTS of surface and groundwater to the City of Los Angeles. Politics and money superseded this plan and any plan.

Surface water is being confused with stormwater as stormwater is a NPDES permitted process with Total Daily Maximum Load reductions required. It does not involve urban runoff until the LA Regional Water Quality Control Board confused the issue and requires urban runoff to be captured as a TMDL compliance before entering any water body, regardless of the Clean Water Act jurisdiction.

Omitted is an approach to emissions from the Land and the extractions from Land such as Methane emissions. Without a Land Use approach, reporting and mitigation of oil field leakage, especially in the urban environment of cities like Los Angeles, one cannot rely on outcomes stated. In fact, Objective 7 is bypassed. There is no baseline for comparison and no method for detection for continuous greenhouse gas emissions. 3-1 cont'd

Inventory was created on limited sources, not the environmental picture and the sources of emission, whether man-made or not.

Also bypassed, is the geoengineering of the sky through the coined-term "chem trails". Those emissions are not ground based and are omitted from any alternative. This may or may not involve Public Law such as National Defense Authorization Act for Fiscal Year 1998 Section 1078 research activity or any such related activity in Federal law.

The Local Government partner is omitted from any alternative. There is an assumption that Infrastructure is up-to-date and funded. Attached is a 2010-2011 Infrastructure Report for the City of Los Angeles with low grades and high unfunded liabilities.

Your ALTERNATIVE 2 statement has no basis in merit since the No Project Alternative has no baseline inventory:

> *Therefore, while Alternative 2 meets some of the basic project objectives, it would likely achieve substantially fewer GHG emission reductions and overall is less effective at achieving the project objectives compared to the Proposed Update.*

Your ALTERNATIVE 3 does not satisfy Objectives 11, 13 or 14.

The three Alternatives are not sufficient to meet any Project Objectives and no framework to accomplish those goals past 2020.

There are not sufficient Alternatives to accomplish the Project Description and the Project Objectives. 3-1 cont'd

Joyce Dillard
P.O. Box 31377
Los Angeles, CA 90031

Attachment:
INFRASTRUCTURE REPORT CARD_2010_2011 B&W

Comment Letter 3 Response

3-1 The commenter quotes text from Section 2.A of the EA, "Overview of the Proposed First Update and Scope of the 'Project' under CEQA," and Section 2.B, which lists the project objectives. With consideration of this quoted text, the commenter expresses concern that the alternatives are not consistent with some of the quoted text.

While ARB, by virtue of its certified program, is exempt from Chapters 3 and 4 of CEQA and the corresponding sections of the State CEQA Guidelines, the Guidelines contain useful information for preparation of a thorough and meaningful alternatives analysis. California Code Regulations, title 14, section 15126.6, subdivision (a) speaks to evaluation of "a range of reasonable alternatives to the project, or the location of the project, which would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects, and evaluate the comparative merits of the alternatives." The purpose of the alternatives analysis is to determine whether or not different approaches to or variations of the project would reduce or eliminate significant project impacts within the basic framework of the objectives, a principle that is consistent with ARB's requirements under its certified regulatory program.

Section 7 of the Draft EA entitled "Alternatives Analysis" provides a description of three alternatives: No-Project Alternative, Reduced-Intensity Project Alternative, and Extend the Cap-and-Trade Regulation to All Economic Sectors Alternative. The alternatives analysis describes each alternative's relationship to the project objectives (listed in Section 7.C of the EA) and the potential environmental impacts.

The comment provides a discussion of specific issues that were perceived to not be mitigated in the Alternatives Analysis. Examples included improvements to Public Health, preservation of Natural Resources, and unexpected emissions increases. However, the purpose of the Draft EA is to evaluate the potential for significant adverse impacts associated with the reasonably foreseeable compliance responses that are likely to occur as a result of implementation of the Project, namely the recommended actions identified in each of the nine sectors discussed in the Update (see page 3 of the Draft EA). The recommended actions were developed to address the project objectives, which were derived from the requirements of AB 32 (AB 32, Statutes of 2006, Chapter 488).

The Update builds upon the approach of the initial Scoping Plan by recommending a balanced mix of broad-based sector strategies and recommended actions for the State to ensure that California remains on track to meet the near-term 2020 GHG emissions limit and continues on a downward

GHG emissions trajectory consistent with achieving the State's long-term climate stabilization objectives, while maintaining a vibrant, clean, and sustainable California economy. Likewise, suitable alternatives considered in the EA also need to be broad-based, comprehensive approaches that could meet the basic project objectives, while reducing or eliminating the project's identified significant effects on the environment.

ARB identified a reasonable range of three alternatives that allow the public and Board to understand different comprehensive approaches to meet the project objective. In addition to a discussion of the No Project Alternative, ARB made a good faith effort to identify other potentially feasible project alternatives. Efforts included examining comments received at the public workshops held in June, July, and October of 2013, and at the Board hearings held in October 2013 and February 2014 to determine if any commenters suggested potentially feasible alternatives. The comments appear to be focused on particular components associated with the project overview and project objectives, rather than an alternative broad-based comprehensive approach to the project itself. Absent a more detailed critique of the alternatives and absent any suggestions for alternatives that could better meet the overall project objectives while reducing or eliminating the identified environmental impacts, staff is unable to provide a more detailed response.

1 Letter 4

April 28, 2014

Michael Tollstrup
California Air Resources Board 1001
"I" Street
Sacramento, CA 95814

Submitted via CARB comments webpage:
http://www.arb.ca.gov/cc/scopingplan/2013comments.htm

RE: Comments on the California Air Resources Board (CARB) 2014 Draft First Update to AB 32 Scoping Plan ("Draft") and It's Supporting Appendix B, Appendix C (Working Paper on Transportation), and Appendix F (Draft Environmental Analysis)

Dear Mr. Tollstrup:

I appreciate the opportunity to offer these transportation-related comments on the 2014 Draft First Update to the AB 32 Scoping Plan ("Draft") and its Appendices B, C, and especially F, the Environmental Analysis for the Draft. I am a retired satellite systems engineer. I worked for 36 years at Lockheed Martin in Sunnyvale. I have a BSEE and an MSE in engineering. I am now the Transportation Chair, speaking for a large and well-known environmental organization on regional issues, in my region, here in San Diego. Climate-transportation is a systems engineering problem. I have published and presented four times with the Air and Waste Management Association on subjects relating to how this problem can be solved.

Given the shortcomings of the Draft, if it were to be adopted as the CARB 2014 Update to AB 32 Scoping Plan ("Update"), it would itself, contribute to the ultimate human catastrophe of destabilizing our climate. It fails to do what if must do, which is to ensure that cars and light duty trucks ("LDVs") in California will support climate stabilization.

Note that the four documents identified in the subject of this letter (the Draft and its 3 appendices) will be referred to as the "Subject Documents".

I. THE SUBJECT DOCUMENTS FAIL TO STATE THAT ANY CALIFORNIA AB 32 GOBAL-WARMING SCOPING PLAN THAT FAILS TO ENSURE THAT LDVs SUPPORT CLIMATE STABILIZATION COULD DO GREAT AND IRREPARABLE ENVIRONMENTAL HARM, THEREBY MAKING IT A *PROJECT*, UNDER CALIFORNIA ENVIRONMENTAL QUALITY ACT LAW. 4-1

For example, AB 32 requires that all measures that

- would reduce greenhouse gas (GHG) emissions and
- are technologically feasible and cost effective

be adopted. This is reasonable, given the severity of our climate crisis. It will be shown in this response letter that measures that would greatly reduce emissions from the car and light-duty (Light-Duty Vehicle or "LDV") sector that are both technologically feasible and cost effective have been perhaps overlooked but most certainly not described or considered in this Draft. If the final version of the *California Air Resources Board (CARB) 2014 First Update to AB 32 Scoping Plan* ("Update") continues to ignore these measures, it will send a message to the world that California perhaps cares more about pleasing its oil industry and its road-building lobby than it cares about helping to solve the climate crisis. It is unreasonable to expect China and India, for example, to stop building coal-fired electrical generating plants, if we continue to widen our freeways, as we have done for the last six decades (helping to produce a "drive everywhere" life style, a high average commute length, and a high level of per-capita driving and CO2_e emissions).

2

As another example, if this Draft adopts CO2_e emission-reduction goals that are insufficient to support climate stabilization, this would put the state of California on a path to climate failure. The negative impact of this would be unacceptably large.

II. THE SUBJECT DOCUMENTS FAIL TO DESCRIBE THE FUNDAMENTAL NATURE OF THE CLIMATE THREAT WE NOW FACE, WHICH IS NECESSAY, SO READERS CAN UNDERSTAND WHAT MEASURES AND LEVEL-OF-EFFORT ARE APPROPRIATE.

Genocide requires an inner circle of dangerously misguided (some would say evil) leaders and a large number of complicit government enablers. Climate destabilization, which would result in a "devastating collapse of the human population" (quote taken from the June 2008 issue of *Scientific American*, on its Page 100, within its featured article, *The Ethics and Economics of Climate Change*) is far worse than genocide, for it will most likely kill off most life forms on our currently-magnificent, teaming-with-life, planet. Facilitating this unbelievably gruesome process requires many sets of misguided leaders and complicit government enablers. With this Draft, CARB is mistakenly playing the role of a complicit government enabler. This is unacceptable. 4-2

Please consider how this Draft talks around climate destabilization's unbelievably-large potential for harm.

On Page 1, it says, " global warming poses a serious threat to the economic wellbeing, public health, natural resources and environment of California". Killing most life forms on the planet is the reality and the selected words are misleading. The words used are closer to the truth if they are applied to climate *success*, given our current prospects. climate *failure* (destabilization) will be an entirely different outcome. "Economic health" has no meaning if there are no people left.

On Page 2, it says, " catastrophic climate change". However, why climate change could be "catastrophic" is never explained in plain English. Who are the authors trying to protect? If they are concerned that children might read the Draft and they don't want to traumatize them, they should consider that if children understood what was going on, they would rather have the facts fully explained, as disturbing and distasteful as they are.

On Page 6, it says " climate goals" and " climate objectives". However, given our predicament, what is needed is a climate *requirement*, where that *requirement* is to achieve the greenhouse gas (GHG) reductions that, if achieved by the world, going forward from 2014, will guarantee climate stabilization at a livable level.

On Page 6, it says, "In addition to our climate objectives, California must also meet federal clean air standards." While I don't take sickness and life-ending cancer lightly, this is still similar to saying that in addition to not hitting an ice berg and sinking, the Titanic should prepare healthy meals for everyone. Statistically speaking, healthy meals will extend life and reduce the likelihood of life-ending sickness. Sinking in the frigid waters of the Atlantic Ocean was an outcome of a very different nature. Something to the effect of "In meeting our climate *requirements*, it so happens that we will also meet our federal clean air standards" would be appropriate.

On Page 9, it says, " avoid the most severe impacts of climate change." What are those "most severe impacts"? Again, who is the Draft trying to protect, the oil companies or the children?

On Page 11 it says, " avoid the worst impacts of climate change ." However, the Draft never explains what those impacts might be. Will we only have to turn up our air conditioners or is it something more serious?

On Page 13 is says, " the first Climate Change Adaptation Strategy for California ." However, nowhere is the key fact stated that without sufficient mitigation, no adaptation is possible. Without sufficient mitigation, any and all adaptation strategies will be overwhelmed. Any adaptation strategy must explain what climate outcome is being assumed.

On Page 14 is says, " 2° C poses severe risks to natural systems and human health and well-being."

Nowhere in the Draft are these "severe risks" explained.

III. THIS DRAFT FAILS TO EXPLAIN WHAT DESTABILIZATION IS

Destabilization (sometimes called the tipping point) occurs when positive feedbacks take over and we lose all control, as the climate proceeds to warm so much that the planet is uninhabitable to most of its current life forms, including our own.

Positive feedback is any process where the warmer it gets, the more the process causes warming.

Two examples are

- the loss of ice mass that reflects a significant amount of the solar radiation it receives, because the warmer it gets, the less ice there is to reflect solar radiation and
- the melting of what was permafrost, giving off methane gas, a powerful greenhouse gas (GHG), because the warmer it gets, the more methane gas is put into the atmosphere.

4-3

These two positive feedbacks are underway and will be accelerated as more heat is trapped by our ever-increasing, elevated levels of atmospheric CO2. There is probably still hope that we can avoid destabilization. Destabilization must be avoided because it is such a bad outcome (loss of most life, including our own). This justifies doing hard work, making hard choices, and adopting significant changes.

IV. THE SUBJECT DOCUMENTS FAIL TO STATE THAT SUPPORTING CLIMATE STABILIZATION MUST BE, BY THE VERY NATURE OF DESTABILIZATION, A HARD AND FAST *REQUIREMENT*, NOT A GOAL AND NOT AN OBJECTIVE.

4-4

Stating the obvious, destabilization must be avoided at all costs, because it is so dire. Therefore, climate stabilization must be supported. Achieving that support must be a requirement.

V. THE SUBJECT DOCUMENTS FAIL TO TAKE ANY POSITION WHATSOEVER, ON WHAT CO2_e REDUCTION RATES ARE NEEDED TO ACHIEVE SUPPORT FOR CLIMATE STABILIZATION

The Draft presents the Governor's Executive Order S-3-05 ("S-3-05") and its three targets, on Page 1, where it also states that it was designed such that if the world's developed nations had achieved those targets, the atmospheric levels of CO2_e would be capped at 450 PPM, in the year of 2050. This fact is informative and historically important. However it is now 2014 and we know that in the nine years since the formulation of S-3-05, the industrialized world has failed to achieve the S-3-05 trajectory. The Draft makes it clear that achieving S-3-05 is not just hitting the targets, but is instead progressing from target to target with each year's CO2_e emission levels near or, better yet, below the straight-line that connects the target points, as shown in the Draft's Figure 6. This is true because what matters the most is the area under the achieved sets of year-by-year emission levels, which correspond to the net CO2_e emitted. For example, on the Draft's Figure 6, the blue-dashed line is preferable to the red line, because the area under that line, the total CO2_e emitted, is less.

4-5

However, at this point, it is clear to any climate realist that the S-3-05 target for 2050 is now too late, because, besides other reasons, the world's emissions, from 2005 to 2014 have put amounts of CO2_e into the atmosphere that far exceed what was allowed under S-3-05. The draft never makes a definitive statement about what must be done, given this situation. What targets are now needed? The Draft never states anything on that topic, but proceeds as if S-3-05 is still sufficient.

VI. THE SUBJECT DOCUMENTS ATTEMPT TO GET THE READER TO ACCEPT THE FALSE NOTION THAT S-3-05 IS A LEGITMATE REQUIREMENT TO SUPPORT CLIMATE STABILIZATION.

4-6

That S-3-05 is somehow sufficient is an absurd conclusion, based on the statements that appear in the Draft and also when considering other facts surrounding S-3-05. As stated at the top of the Draft's Page 2, S-3-05, if it had been achieved by the world, would have stabilized the atmospheric level of

CO2_e at 450 PPM[1] by the year of 2050 and this would have *reduced the likelihood* (emphasis added to point out that there is no assurance, rather, it is simply stated that the likelihood is reduced and furthermore, how *much* the likelihood is reduced is not stated) of catastrophic climate change. It also aimed for "only" a 2°C increase in temperature, from preindustrial temperature. This "aiming" generally means that there would have been a 50% chance that the increase would be less than 2°C and there would have been a 50% chance that it would have been larger than 2°C. However, even this discussion of what might have been is overly optimistic. On Page 14, it is stated that 2°C poses a "severe risk to the natural systems and human health and wellbeing." However all of this hope that S-3-05 would have been sufficient was probably misplaced all along. As shown on Page 14, a 2009 study which "synthesized many studies on climate" concluded that we would have needed to stabilize the atmospheric levels of CO2_ at 400 PPM, and that even if we did that, there would have been a 20% chance of exceeding 2°C. This is a good indication of how much trouble we are in because the current atmospheric level of CO2_e exceeded 400 PPM, several months ago. But it gets even worse. A recent paper by what may be the world's best climate scientists, including our own pre-eminent climate scientist, Dr. James Hansen, states that the 2°C target has always been too high and may in fact cause "irreparable harm to nature and future generations". 4-6 cont'd

VII. A REASONABLE CALIFORNIA TARGET TO SUPPORT CLIMATE STABILIZATION AT A LIVABLE LEVEL IS 80% BELOW THE 1990 LEVEL BY 2030, NOT 2050, AS DEFINED IN S-3-05.

Reference 1, using an Amicus Brief from James Hansen and other climate scientists, concludes that if California wants to set an example for the world, which is the only responsible action, given what we know, the correct target beyond 2020 is to reduce emission down to 80% below our 1990 levels by 2030. This is a full 20 years sooner than the third S-3-05 target. (Reference 1 also develops a set of requirements for California cars and light-duty trucks so that they can support this target.) 4-7

VIII. THE SUBJECT DOCUMENTS LEAVE OUT THE CRITICAL INFORMATION THAT CARB'S SB-375 TARGETS TO THE METROPOLITAN PLANNING ORGANIZATIONS (MPOs) FAILED TO EVEN SUPPORT S-3-05

As an example, this failure will be shown for the MPO named SANDAG, the San Diego Association of Governments. First, the target CARB gave to SANDAG is shown in this Wikipedia link, http://en.wikipedia.org/wiki/SB_375. As shown there, it was just 13%, which is exactly what SANDAG requested, so that they could continue to build all of their planned freeway expansions. However, using the car-efficiency data compiled by Steve Winkelman, Reference 1 derives the SB-375 target for 2035 that supports S-3-05. It is 35.1%. This derivation is shown, in painstaking detail, on Pages 3 through 9 of Reference 1, in its section titled, *The Required Driving Reduction for San Diego County, for 2035, Using Winkelman's LDV and Fuel Efficiency Values and S-3-05*. 4-8

IX. THE SUBJECT DOCUMENTS NEED TO BE CHANGED SO THAT IT ESTABLISHES AND APPLIES NEW SB 375 TARGETS TO THE MPOS THAT WILL, ALONG WITH A SET OF REQUIREMENTS TO CLEAN UP OUR FLEET OF LDVS, SUPPORT CLIMATE STABILIZATION.

Reference 1 does this very thing. Reference 1 has been peer reviewed and accepted by the Air and Waste Management Association (AWMA). It will be published as part of the proceedings of AWMA's yearly conference, this June, in Long Beach. The paper will be presented there in a panel discussion. 4-9

X. THE SUBJECT DOCUMENTS FAIL TO DISCLOSE THAT THE ACT OF PROVIDING SB 375 TARGETS HAS SIGNIFICANT ENVIRONMENTAL CONSEQUENCES AND SHOULD HAVE BEEN CONSIDERED A PROJECT UNDER CEQA AND IF IT HAD BEEN, THE FACT THAT THE TARGETS 4-10

[1] This stabilization of atmospheric CO2_e should not be confused with stabilizing the climate.

IGNORED S-3-05 COULD HAVE BEEN EXPOSED AND PERHAPS PREVENTED.

The Draft needs to provide this information. That will make it clear that CARB is now going to provide the MPOs with SB 375 targets for 2035 that will support stabilization. As will be shown, CARB can also provide the MPOs with the help they need to ensure that the LDV sector will support climate stabilization. 4-10 cont'd

XI. THE SUBJECT DOCUMENTS OMIT THE FACT THAT SANDAG, FOLLOWING CARB'S LEAD OF IGNORING S-3-05, WAS FOUND TO BE IN VIOLATION OF CEQA AND IN FACT THE FINAL RULING AGAINST SANDAG, IN SUPERIOR COURT, STATED THAT THE EIR FOR THEIR RTP WAS "IMPERMISSIBLY DISSMISSIVE OF S-3-05".

SANDAG, following the bad example set by CARB, of ignoring S-3-05 and its responsibility to support stabilization is unapologetic and is in fact appealing the case, using money that should instead be used to improve active transportation and transit. Keeping these important and relevant facts hidden from the reader is part of a criminal conspiracy to protect the parts of the status quo that have been a large contributor to our current climate crisis, as much as possible and as long as possible,. 4-11

XII. AFTER ESTABLISHING THE CO2_E REDUCTIONS REQUIRED TO SUPPORT CLIMATE STABILIZATION, AS SHOWN IN VII ABOVE, THE SUBJECT DOCUMENTS MUST DEVELOP AND ADOPT A PLAN, FOR EACH EMITTING SECTOR OF THE ECONOMY, TO ACHIEVE THOSE REDUCTIONS.

Climate stabilization is, among other things, a math problem. It is certainly a systems engineering problem. The task described in XII should be viewed as the primary purpose of the subject documents. The LDV sector is complicated by the fact that car efficiency (including the low-carbon fuel standard, LCFS) is controlled primarily by the state but driving reduction strategies are often under local control. However, CARB, thanks to SB 375, has the ability to apply the needed driving reductions to the MPOs. Therefore, the Subject Documents needs to have an overall plan to ensure that LDVs will support stabilization. Reference 1 shows such a plan. In fact, it develops two sets of requirements. One is called "Heroic Measures", due to its required rapid adoption of Zero Emission Vehicles (ZEVs) into California's fleet. It also has an "Extra Heroic Measures" set of requirements, created to satisfy those that want to continue to support the 2005 level of per-capita driving. Most would agree that the "Extra Heroic Measures" rate of ZEV adoption is not achievable. Reference 1 is only a start and only an example of the work that must be done. 4-12

XIII. FOR LDVS, A SET OF MEASURES MUST BE DEVELOPED AND INCLUDED IN THE SUBJECT DOCUMENTS THAT WILL ACHIEVE THE NEEDED DRIVING REDUCTIONS TO SUPPORT CLIMATE STABILIZATION

An example of such a list is given in Reference 1, on its Pages 17 to 20. All of the measures are technologically feasible and cost effective and therefore must be included in the Update and in the MPOs SCS (under SB 375, these are the Sustainable Communities Strategies, containing only measures that would be feasible for the MPO or for the MPO's local governments) and APS (under SB 375, these are the Alternative Planning Strategies, containing only measures that would be infeasible for the MPO or for the MPO's local governments), as part of their next Regional Transportation Plan (RTP). 4-13

XIV. THE SET OF MEASURES IDENTIFIED IN XIII ABOVE MUST INCLUDE A COMPREHENSIVE ROAD-USE FEE PRICING AND PAYOUT SYSTEM

This measure is identified on Page 18 of Reference 1. *Comprehensive* means that pricing would be set to cover all costs (including road maintenance and externalities, such as harm to the environment and health); that privacy and the interests of low-income drivers doing necessary driving would be protected to the greatest extent possible; that the incentive to drive fuel-efficient 4-14

cars would be at least as large as it is under the current fuels excise tax; and, as good technology becomes available, that congestion pricing is used to protect at least critical driving and perhaps all driving from congestion.

The words *payout* and *unbundle* mean that some of the money collected would go to people that are losing money under the current system. User fees (currently just gas taxes and tolls) are not enough to cover road costs as shown in an article *Gasoline Taxes and Tolls Pay for Only a Third of State & Local Road Spending*, viewable here, http://taxfoundation.org/article/gasoline-taxes-and-tolls-pay-only-third-state-local-road-spending. In fact, the article shows that in California, only 22.7% of state and local road spending is covered by user fees.

More than any other California agency, CARB should be aware of the fact that as our fleet of cars gets more efficient, there will be a continuously dwindling amount of gas tax revenue available. This means that our indefensibly bad situation will get worse. The large number of ZEVs needed mean that gas tax revenues will drop precipitously. What is the CARB recommendation to solve this obvious problem? The Draft indicates a desire to increase fairness, but what is fair about forcing those that drive less to subsidize those that drive more? Obviously, subsidizing driving increases the *amount* of driving and thus increasing the CO2_e emissions. 4-14 cont'd

It is impossible to believe that CARB has been unaware of these facts, which have been noted for decades. The first significant thing that Republican Congressman Ray LaHood said after he became President Obama's first Secretary of Transportation is that the gas tax was inadequate and it was time for what he called a "VMT Fee". ("Road-Use Fee" is a better description since the rate per mile would need to vary depending on a handful of variables, such as type of car.) There is nothing technologically infeasible or that is not cost effective about this measure.

This situation shows that CARB has been ignoring a technologically feasible and cost effective measure to reduce emissions, a clear violation of AB 32. The first Resolution shown in this letter's Appendix A contains more details on this measure.

XV. THE SET OF MEASURES IDENTIFIED IN XIII ABOVE MUST INCLUDE A DESCRIPTION OF A PLAN TO UNBUNDLE THE COST OF MOST PARKING THAT IS NOW BUNDLED-COST PARKING, STARTING WITH GETTING DEMONSTRATION PROJECTS THAT DEVELOP AND INSTALL REDUCED-FEATURED SYSTEMS

Reference 2 explains how a reduced-feature demonstration project could be developed and implemented. Reference 2 shows that the concept is feasible and cost effective. It would also increase fairness, transparency, and economic choice. Since its potential to reduce driving is large, it would be unacceptable for this measure to be left out of the Subject Documents. The second Resolution shown in Appendix A contains more details on this measure. 4-15

The ultimate and needed change would be the full implementation, as described here, http://www.sandiego.gov/environmental-services/pdf/sustainable/parkingcosts.pdf.

XVI. APPENDIX D'S TABLE 2-2, ON PAGES 15 THROUGH 17 IS DEFICIENT IN THAT IT ASSUMES THERE IS NO CARB RESPONSIBILITY TO IDENTIFY BOTH A TARGET THAT WOULD RELIABLY SUPPORT CLIMATE STABILIZATION AND A SET OF MEASURES THAT WOULD ENSURE THAT THE LDV SECTOR ACHIEVES THAT CLIMATE STABILIZATION TARGET

4-16

There is nothing in this table about how these measures might or might not support climate stabilization. It is clearly the work of an organization that does not realize that it has a responsibility to identify what target will support climate stabilization and what transportation measures will cause the LDV sector to achieve the target. Reference 1, which is also Appendix B in this letter does both of these things: it identifies the target and derives a set of actions to

achieve the target.

CEQA requires that negative impacts be considered. At a minimum this would require that climate destabilization be accurately described in terms of how bad it will get with insufficient reductions in the burning of fossil fuels (extinction of most species) and what it would take to support the avoidance of such destabilization. Table 2-2 contains measures with no accounting for how much they might collectively reduce CO_2 emissions. However, Reference 1 shows that is not even close to what is needed. Sadly, thanks to the impermissibly deficient nature of the Subject Documents, the reader has no way of knowing how far Table 2-2 is from achieving support for climate stabilization at a livable level. 4-16 cont'd

XVII. **APPENDIX D'S TABLE 2-2 SHOWS CARB STILL DOES NOT KNOW THAT WHEN SANDAG WAS FOUND TO BE "IMPERMISSIBLY DISMISSIVE OF S-3-05", EVEN THOUGH IT MET ITS SB-375 TARGETS, THAT WAS A CLEAR INDICATION THAT CARB SHOULD HAVE PROVIDED TARGETS THAT WOULD HAVE, AT THE VERY LEAST, SUPPORTED S-3-05.**

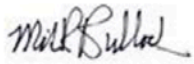
This in no way excuses SANDAG. Clearly CARB and SANDAG engaged in a conspiracy to betray the public trust by defeating the intent of SB 375, which is to support climate stabilization. They did this by pretending that ignoring the S-3-05 trajectory, which was thought by some to provide a path to climate stabilization, was responsible behavior. Behavior which leads to climate failure is irresponsible and unacceptable. Even now, Table 2-2's first sentence, under the "Transportation, Land Use and Housing" heading, says they will do a "technical review" to "inform the need" for revisions" and the "appropriate timing" of the revisions. Of course the climate-killing targets need to be fixed. This was pointed out in 2010 in Reference 4. The first 30 pages of Reference 4 is shown as Appendix D. Since SB 375 does not allow strengthening the targets for 8 years, CARB needs to admit its crime against humanity, and ask the legislature to pass a law to allow them to impose climate-stabilization-supporting targets to replace the climate-killing targets they gave the MPOs back in 2010. 4-17

XVIII. **TABLE 2-2 MEASURES INCLUDE NOTHING ABOUT IMPROVING THE WAY WE PAY FOR ROADS AND PARKING, AS IF MONEY MEANS NOTHING AND AS IF CARB STAFF IS INCAPABLE OF NOTICING THAT THE GAS TAX ACCOUNTS HAVE A POOR FUTURE, SINCE WE MUST HAVE SUBTANTIALLY CLEANER CARS AND AS IF CARB STAFF IS INCAPABLE OF NOTICING THAT BUNDLING THE COST OF PARKING, AT MOST LOCATIONS, IS INCREASING THE USE OF LDVS FOR TRANSPORTATION AND, FINALLY, AS IF CARB NEVER RECEIVED REFERENCE 4.** 4-18

XIX. **THE FOUR "COMPLIANCE RESPONSES" SHOWN IN APPENDIX E, JUST AFTER ITS TABLE 2-2, REPEAT THE UNACCEPTABLE OVERSIGHTS THAT ARE IDENTIFIED IN XVII ABOVE.** 4-19

XX. **PAGE 10 OF ATTACHMENT 3 OF APPENDIX F HAS A DEFICIENT, COVER-UP DESCRIPTION OF THE DISASTEROUS ENVIRONMENTAL CONSEQUENCES OF GIVING THE MPOS THE EXACT TARGETS THEY REQUESTED, TARGETS THAT IN NO WAY CAME EVEN CLOSE TO SUPPORTING THE S-3-05 TRAJECTORY.** 4-20

Sincerely,



Mike Bullock

California Democratic Party Delegate, 76 AD (author of 2 adopted resolution and 5 Platform changes)
Elected Member of the San Diego County Democratic Party Central Committee (author of 5 adopted resolutions)
Satellite Systems Engineer, 36 years (Retired for 7 years)
Air and Waste Management Association published and presented (or to be presented; the first will be presented in June) papers:
Author, ***The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving***
Author, ***A Climate-Killing Regional Transportation Plan Winds Up in Court: Background and Remedies***
Co-author, ***A Plan to Efficiently and Conveniently Unbundle Car Parking Cost***
http://www.sandiego.gov/environmental-services/pdf/sustainable/parkingcosts.pdf

Memberships (not denoting support for this email):

Sierra Club San Diego's 2011 Volunteer of the Year
Oceanside Bicycle Committee
SVBC
CirculateSD
CNFF
Action4Oceanside

References

1. Bullock, M.; *The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving*; Paper 2014-30793-AWMA, from the Air and Waste Management Association's 2014 Annual Conference and Exhibition; Long Beach, California, June 24-27, 2014. (Also shown as Appendix B)
2. Bullock, M.; *Equitable and Environmentally-Sound Car Parking Policy at Schools*; July 20, 2011. Unpublished. Available from mike_bullock@earthling.net, upon request. (Also shown as Appendix C)
3. Bullock, M.; Stewart, J.; *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*; Paper 2010-A-554-AWMA, from the Air and Waste Management Association's 103rd Annual Conference and Exhibition; Calgary, Canada, June 21-24, 2010. http://sierraclub.typepad.com/files/mike-bullock-parking-paper.pdf
4. *Comments on the Draft GHG Reductions, Pursuant to Senate Bill 375*, July 21, 2010, Letter summited to CARB regarding their targets to MPOs, from M. Bullock (Also shown as Appendix D.)

Comment Letter 4 Response

4-1 With regards to the reference about projects under CEQA, California Code of Regulations, title 14, section 15378 defines a project as:

a) "Project" means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following:

(1) An activity directly undertaken by any public agency including but not limited to public works construction and related activities clearing or grading of land, improvements to existing public structures, enactment and amendment of zoning ordinances, and the adoption and amendment of local General Plans or elements thereof pursuant to Government Code Sections 65100–65700.

(2) An activity undertaken by a person which is supported in whole or in part through public agency contacts, grants, subsidies, loans, or other forms of assistance from one or more public agencies.

(3) An activity involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

Section 2, "Project Description," in the Draft EA provides the description of the project (the Update) under consideration.

Recommended actions associated with the Transportation Sector of the Update include GHG emissions related to cars and trucks.

4-2 This is not a comment related to the EA. Nonetheless, staff notes that Section II of the Update provides an overview of the latest climate science, including trends, evidence of climate change, and the need to achieve climate stabilization. The Update describes the continuing evidence of climate change in California on pages 11 – 14.

4-3 This is not a comment related to the EA. Nonetheless, staff notes that Page 14 of the Update describes, in detail, the concept of climate stabilization. Several indicators of climate change are discussed, including ice loss, sea-level rise, ocean acidification, heat waves, and air quality effects (page 10 of the Update).

4-4 See response to comments 4-3.

4-5 This is not a comment related to the EA. Nonetheless, staff notes that Page 2 of the Update describes GHG emissions reductions to reach 1990 levels. Page 1 of the Draft EA states that: "The Proposed Update highlights California's success to date in reducing GHG emissions and lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050, as required by AB 32, Executive Order S-3-05, and Governor Brown's Executive Order B-16-2012. The 2050 objective is consistent with an Intergovernmental Panel on Climate Change (IPCC)[1] analysis of the emissions trajectory that would stabilize atmospheric GHG concentrations at 450 parts per million carbon dioxide equivalent (CO_2e) and reduce the likelihood of catastrophic climate change."

4-6 This is not a comment related to the EA. Nonetheless, staff notes that the comprehensive approach in the initial Scoping Plan addressed key criteria, including technological feasibility, cost-effectiveness, overall societal benefits, and impacts on specific sectors such as small business and disproportionately impacted communities. The thorough planning process underlying the initial Scoping Plan and this Update helps to ensure that California meets its GHG reduction targets in a way that promotes and rewards innovation, helps to foster economic growth, and delivers improvements to the environment and public health, including in the most affected communities.

Key elements of the initial Scoping Plan included the following:

- Expand and strengthen energy efficiency programs, including building and appliance standards.
- Increase electricity generation from renewable resources to at least 33 percent of the statewide electricity mix by 2020.
- Establish targets for passenger vehicle-related GHG emissions for regions throughout California and pursue policies and incentives to achieve those targets.
- Adopt and implement measures pursuant to existing State laws and policies, including California's clean car standards and the Low Carbon Fuel Standard.
- Develop a cap-and-trade program to ensure the target is met, while providing flexibility to California businesses to reduce emissions at low cost.

The initial Scoping Plan identified specific GHG emission reduction measures that would assist the State in meeting the 2020 limit. A discussion of the status of all of the Scoping Plan measures is included in Appendix B of the Update.

4-7 See response to comments 4-5.

[1] The IPCC is the leading international body for the scientific assessment of climate change established in 1988 under the auspices of the United Nations.

4-8 This is not a comment related to the EA. Nonetheless, staff notes that the Board received a briefing on the status of Senate Bill (SB) 375 implementation at its January 23, 2014 meeting. The Board directed staff to obtain input from stakeholders to inform the need for and timing of a regional targets update. Over the next several months, ARB staff is convening a diverse group of stakeholders to participate in a roundtable discussion format to explore issues related to target-setting and to think strategically about appropriate methodologies for updating the targets. All the roundtable meetings are open to the public and members of the public will be welcome to observe the discussions and participate during a public comment segment of each meeting. More information about SB 375 can be found at: http://www.arb.ca.gov/cc/sb375/sb375.htm

4-9 This is not a comment related to the EA. Nonetheless, reference 1 is noted. See response to comment 4-8.

4-10 This is not a comment related to the current draft EA prepared for the Update. For information related to the SB 375 process, please see: http://www.arb.ca.gov/cc/sb375/sb375.htm

4-11 This is not a comment related to the EA. Issues related to SANDAG documents are not within the scope of the Update or the draft EA prepared for the Update.

4-12 This is not a comment related to the EA. Nonetheless, the comments are noted. The Update provides a plan for each emitting sector of the environment.

4-13 See response to comments 4-8.

4-14 This is not a comment related to the EA.

4-15 See response to comment 4-14.

4-16 This is not a comment related to the EA. Nonetheless, staff notes that climate stabilization is discussed in Section II.B of the Update. Section IV.B, Progress to Date, in the Update described key accomplishments, GHG emissions trends, and emission reductions to meet the 2020 Statewide limit.

4-17 See response to comments 4-11.

4-18 This is not a comment related to the EA.

4-19 See response to comments 4-11.

4-20 The commenter provides no supporting evidence or discussion of why page 10 of attachment 3 of appendix is deficient. Thus, staff is unable to provide a more detailed response.

Letter 5

CENTER *for* BIOLOGICAL DIVERSITY

April 28, 2014

Via internet upload (www.arb.ca.gov)

Clerk of the Board
Air Resources Board
1001 I Street
Sacramento, California 95814

Re: Draft Environmental Analysis for the Proposed First Update to the Climate Change Scoping Plan

Members and Staff of the California Air Resources Board:

The Center for Biological Diversity (the "Center") submits the following comments concerning the Draft Environmental Analysis ("EA") for the Proposed First Update to the Climate Change Scoping Plan ("Proposed First Update"). The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has more than 775,000 members and online activists throughout the United States, including more than 100,000 in California. The goal of the Center's Climate Law Institute is to reduce U.S. greenhouse gas emissions and other air pollution to protect biological diversity, the environment, and public health. Specific objectives include securing protections for species threatened by the impacts of global warming, ensuring compliance with applicable law in order to reduce greenhouse gas emissions and other air pollution, and educating and mobilizing the public on global warming and air quality issues. 5-1

We thank the California Air Resources Board ("ARB") staff and members for their continued efforts to reduce greenhouse pollution and implement California's Global Warming Solutions Law ("AB 32"). Despite these diligent efforts, the EA contains serious flaws that undermine both its analysis and its conclusions, as well as rationales behind some of the measures in the Proposed First Update.

In particular, the EA does not meet the minimum requirements of the California Environmental Quality Act ("CEQA"), Public Resources Code section 21000 et seq., and the CEQA Guidelines, title 14, California Code of Regulations, section 15000 et seq. Many of the deficiencies in the EA—particularly in its contradictory and unsupported discussion of the climatic and terrestrial impacts of increasing reliance on biopower and biofuels—reflect the same erroneous assumptions and evidentiary gaps addressed in the Center's November 1, 2013, comments on the 2013 Scoping Plan Update Discussion

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Draft.[1] That letter, and all accompanying exhibits, are hereby incorporated by reference and will be cited below as appropriate.

Specifically, the EA lacks an accurate and consistent description of the "project" under review; although the Proposed First Update should constitute the project being analyzed, the EA does not accurately reflect all aspects of the updated plan, as set forth in the text of the document itself or in many of the other documents attached or referred to in the document. Furthermore, the EA's analysis of environmental impacts—particularly impacts to forest resources, air quality, and greenhouse gas emissions—is undermined by the lack of a complete and stable project description, as well as by demonstrably erroneous assumptions, internal inconsistencies and contradictions, and the lack of evidentiary support for key conclusions. Where the EA does identify significant impacts, moreover, it fails to consider feasible mitigation measures or alternatives within ARB's control that could reduce or avoid these impacts.

The EA sets forth some laudable principles. For example, energy sector principles include "[t]horoughly account[ing] for the carbon intensity and air quality impacts of various energy resources, generation technologies, and associated fuels" and "[m]inimiz[ing] emissions of criteria air pollutants (CAPs) and toxic air pollutants (TACs)." EA at 9. However, absent accurate disclosure and analysis of the environmental effects of all aspects of the project under consideration—particularly efforts to expand biomass power generation, municipal waste incineration, and biofuels production—the EA cannot achieve these principles. 5-1 cont'd

The Proposed First Update cannot be lawfully approved in reliance on the EA as drafted. Absent compliance with CEQA, the public is unable to understand or meaningfully comment on the environmental implications of the Proposed First Update, and ARB is incapable of making an informed decision that protects California's environment to the greatest possible extent. *See generally Laurel Heights Improvement Assn. v. Regents of University of California*, 47 Cal. 3d 376, 392-94 (1988) ("*Laurel Heights I*"); *Friends of Mammoth v. Board of Supervisors*, 8 Cal. 3d 247, 259 (1972). The EA must be revised to comply with CEQA and recirculated for comment prior to ARB's consideration of the Proposed First Update.

I. Legal Background

ARB's regulatory program, at least in part, is a "certified regulatory program" for purposes of CEQA. Pub. Res. Code § 21080.5; CEQA Guidelines § 15251(d).[2] As such, the EA is considered the "functional equivalent" of an environmental impact report ("EIR"). *Ebbetts Pass Forest Watch v. California Dept. of Forestry & Fire Protection*, 43 Cal. 4th 936, 943 (2008); *POET, LLC v. State Air Res. Bd.*, 218 Cal. App. 4th 681, 5-2

[1] Center for Biological Diversity, Letter to Mary Nichols, Chair, California Air Resources Board, Re: 2013 Scoping Plan Update Discussion Draft (Nov. 1, 2013) ("Center Discussion Draft Comments").
[2] All further undesignated statutory references are to the Public Resources Code.

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709 (2013). Although a formal EIR is not required under a certified regulatory program, ARB nonetheless "must comply with all of CEQA's other requirements." *Mountain Lion Foundation v. Fish & Game Comm'n*, 16 Cal. 4th 105, 113-114 (1997); *POET, LLC*, 218 Cal. App. 4th at 710. Those requirements include the basic information disclosure and environmental protection features of an EIR, including an accurate project description, disclosure and evaluation of significant environmental effects, consideration of feasible alternatives and mitigation measures, and consideration of cumulative impacts. *See Ebbetts Pass*, 43 Cal. 4th at 943-44; *see also POET, LLC*, 218 Cal. App. 4th at 709 ("regulatory programs are certified when they involve 'the same consideration of environmental issues as is provided by use of EIRs and negative declarations'") (quoting CEQA Guidelines § 15002(l)).

Informed decision-making and public participation are central to CEQA's fundamental purpose. *See, e.g.*, *Citizens of Goleta Valley v. Board of Supervisors*, 52 Cal. 3d 553, 564 (1990) (purpose of EIR "is to inform the public and its responsible officials of the environmental consequences of their decisions *before* they are made"); *Laurel Heights I*, 47 Cal. 3d at 394 ("A fundamental purpose of an EIR is to provide decision makers with information they can use in deciding *whether* to approve a proposed project . . . ."); *No Oil, Inc. v. City of Los Angeles*, 13 Cal. 3d 68, 75 (1974) ("an EIR serves to guide an agency in deciding whether to approve or disapprove a proposed project"). Informed decision making, moreover, is essential not only to environmental protection, but also to participatory democracy. "Because the EIR must be certified or rejected by public officials, it is a document of accountability. If CEQA is scrupulously followed, the public will know the basis on which its responsible officials either approve or reject environmentally significant action, and the public, being duly informed, can respond accordingly to action with which it disagrees." *Laurel Heights I*, 47 Cal. 3d at 392. The CEQA process thus "protects not only the environment but also informed self-government." *Id.*

5-2 cont'd

The EA offers a "program-level" analysis of the impacts of the Proposed First Update, and explains that the level of analysis offered is not as "detailed" as would be offered in a project-level assessment. EA at 3. However, ARB may not defer thorough analysis of environmental impacts that can be addressed, given that the agency knows a great deal about what its project entails, simply by stating that the EA is a "programmatic" document. *See, e.g.*, *Friends of Mammoth v. Town of Mammoth Lakes Redevelopment Agency*, 82 Cal.App.4th 511, 533 (2000). To the contrary, the purposes of a programmatic environmental document include providing "an occasion for a *more exhaustive* consideration of effects and alternatives that would be practical in an EIR on an individual action," ensuring "consideration of cumulative effects that might be slighted in a case-by-case analysis," and avoiding "duplicative reconsideration of basic policy considerations." CEQA Guidelines § 15168(b)(1)-(3) (emphasis added). Nor are programmatic documents exempt from CEQA's requirement that public agencies adopt all feasible measures to reduce or avoid significant environmental effects. § 21002. Rather, a programmatic analysis must "consider broad policy alternatives and program

wide mitigation measures at an early time when the agency has greater flexibility to deal with basic problems or cumulative impacts." CEQA Guidelines § 15168(b)(4). 5-2 cont'd

II. The EA's Project Description is Inadequate

In order for an environmental document to adequately evaluate the environmental ramifications of a project, it must describe the proposed project with sufficient detail and accuracy to permit informed decision-making. *See* CEQA Guidelines §15124. Indeed, "[a]n accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR." *San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus*, 27 Cal. App. 4th 713, 730 (1994), quoting *County of Inyo v. City of Los Angeles*, 71 Cal. App. 3d 185, 193 (1977). As a result, courts have found that, even if an environmental document is adequate in all other respects, the use of a "truncated project concept" violates CEQA and mandates the conclusion that the lead agency did not proceed in a manner required by law. *San Joaquin Raptor*, 27 Cal. App. 4th at 730. Furthermore, "[a]n accurate project description is necessary for an intelligent evaluation of the potential environmental effects of a proposed activity." *Id.* (citation omitted). Thus, an inaccurate or incomplete project description renders the analysis of significant environmental impacts inherently unreliable. *See Communities for a Better Env't v. City of Richmond*, 184 Cal. App. 4th 70, 82-83 (2010) (approval of EIR based on inadequate project description constitutes legal error). Because an accurate and stable project description is essential to analysis of environmental effects, and critical to fulfillment of CEQA's fundamental informational goals, these requirements apply with equal force to "functional equivalent" documents prepared under certified regulatory programs. 5-3

The EA's project description fails to meet these standards, largely because the recommended actions and compliance responses discussed in the project description do not fully reflect proposals in the Proposed First Update or the accompanying technical "working papers" (compiled in Proposed First Update Appendix C).

For example, in the description of proposed actions for the transportation sector, the EA acknowledges the Proposed First Update's recommendation to extend and strengthen the low carbon fuel standard ("LCFS"). EA at 16. The Proposed First Update also refers to the expanded role of biofuels under the state's 2012 Bioenergy Action Plan.[3] *See* Proposed First Update at 70. Nothing in the EA's description of compliance responses, however, mentions the role of biofuels (particularly cellulosic biofuels) either in the LCFS context or in the context of the Bioenergy Action Plan. EA at 17.

According to the Bioenergy Action Plan, "[b]iomass is expected to play a key role as a feedstock for the production of transportation fuels needed to meet LCFS and the federal Renewable Fuel Standard (RFS2)."[4] Much of this is expected to come from cellulosic feedstocks (including "woody biomass from dedicated agricultural crops, crop

[3] Bioenergy Interagency Working Group, 2012 Bioenergy Action Plan (Aug. 2012) (attached as Ex.1).
[4] Id. at 12.

and forest residues, and other urban biomass waste") that are not currently in commercial production. The Bioenergy Action Plan estimates the availability of potential cellulosic feedstocks at 18.05M bone dry tons ("BDT") per year.[5] Reaching this potential from the current near-zero level of utilization would obviously represent a huge expansion in feedstock production, harvest, and processing. The EA acknowledges the importance of the Bioenergy Action Plan in other contexts. *See* EA at 21-22 (agriculture sector). Yet the EA fails to identify any anticipated level of biofuels expansion as part of the proposed project.

The waste management section of the project description does not mention any increase in combustion of municipal solid waste ("MSW") and biomass, both of which may result in greenhouse gas ("GHG") and other air pollutant emissions. EA at 24-27. Yet the Proposed First Update includes expansion of "municipal solid waste (MSW) thermal operations (waste-to-energy)" as well as "biomass management (combustion, composting, chip and grind)." Proposed First Update at 75. Moreover, one of the main goals of the Bioenergy Action Plan is to "[i]ncrease energy production from urban-derived biomass."[6] The EA's description of compliance responses, however, refers only to new or expanded "composting and anaerobic digestion facilities"—not new or expanded biomass conversion or waste-to-energy facilities—and makes only oblique references to new offset protocols for "biomass." EA at 26. Expanded biomass combustion and waste-to-energy applications are part of the Proposed First Update and are foreseeable compliance responses. Because the EA omits that these applications are, in fact, part of the project, it cannot provide the basis for adequate analysis of environmental impacts, properly inform decision-makers, and facilitate meaningful public comment. 5-3

Finally, the cap-and-trade section of the project description similarly fails to disclose that the cap-and-trade program—as acknowledged in the Bioenergy Action Plan—was specifically "designed to incent the use of biomass derived fuels" by relieving sources of biomass GHGs from compliance obligations.[7] This section of the project description also fails to identify any recommendations or copmliacne responses associated with new offset protocols for "biomass." EA at 26. Again, these omissions preclude full environmental analysis and frustrate CEQA's informational goals.

[5] Id. at 6.
[6] Id. at 21.
[7] Id. at 13.

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III. The EA Fails to Adequately Disclose, Analyze, and Consider Feasible Mitigation for the Proposed First Update's Significant and Potentially Significant Environmental Effects

A. Agriculture and Forest Resources

Natural and Working Lands Sector

The EA acknowledges that expanding biomass operations may affect forests, although the document claims that there is no way to assess potential impacts because the exact locations and characteristics of biomass facilities are not known and other agencies will be responsible for permitting and mitigation. *See* EA at 56-57. The fact that the EA is a programmatic document cannot excuse this highly generalized, inadequate level of disclosure and analysis.

ARB must make a good-faith effort to disclose, at the level of the Proposed First Update, what overall scale of expansion is planned and what the environmental effects might be. Both the Proposed First Update and the EA recognize that expansion is intended to happen in accordance with the Bioenergy Action Plan. *See* EA at 27, 28 (forecasting "increased use of biomass facilities" as compliance response); *see also* Proposed First Update at 85, 108. A core goal of the BAP is to "increase biomass use for energy production" primarily by "[d]evelop[ing] policies and programs to increase sustainable use of biomass residues from the forestry, agricultural, and urban sectors . . . ."[8] Indeed, the Bioenergy Action Plan's first two goals are (1) to "[i]ncrease environmentally and economically sustainable energy production from biomass residues, including but not limited to forest-derived wood waste, agricultural and food processing waste, wastewater, and urban-derived biomass," and (2) to "[i]ncrease the use of biomass for local distributed generation, combined heat and power facilities, fuel cells, and renewable transportation fuels."[9] The plan also recommends seeking legislative and executive "direction regarding increased biomass use" and working to "[f]acilitate growth of California's biomass industry" by streamlining regulatory processes.[10] Some level of bioenergy expansion is clearly envisioned by the Proposed First Update, and ARB has a responsibility to estimate what level is likely. 5-4

In fact, the scale of expansion could be dramatic. According to the Bioenergy Action Plan, "[t]echnically available biomass is estimated to be approximately 36 million bone dry tons per year (BDT/year) in 2010 and 40 million BDT/year in 2020 (not including purpose grown energy crops). In 2010, existing solid-fuel biomass facilities used about 4.5 million bone-dry tons of biomass residues to generate over 4,300 GWh (less than 15 percent of the resource)."[11] A recent fuel procurement study for a biomass plant in the Lake Tahoe basin estimated that forest fuels treatments would produce an

[8] Id. at 17.
[9] Id. at 18.
[10] Id. at 18-19.
[11] Id. at 10.

average of 13 BDT per acre.[12] At this level of production, generating 36 million BDT from fuels treatments would require logging 2,769,231 acres per year—the equivalent of logging the entire 20.8 million acres of National Forest lands in California about once every 7.5 years. Even at a far more aggressive biomass removal rate of 30 BDT/acre, generating this amount of biomass would require logging 1,200,000 acres per year, the equivalent of logging California's entire National Forest acreage about once every 17 years.

ARB may feel that expanding biomass utilization to the technically available maximum is unrealistic. Yet ARB still has a responsibility to forecast what level of expansion is likely to occur, given that such expansion is an explicit goal of the Proposed First Update and the Bioenergy Action Plan. *See* CEQA Guidelines §§ 15144, 15151. This is especially the case given that the Bioenergy Action Plan and supporting documents for the Proposed First Update acknowledge increased utilization may cause ecosystem damage.[13]

The EA may not avoid this analysis by claiming that development of bioenergy facilities will not result in increased biomass demand. *See* EA at 56-57 (asserting that "[t]he generation of woody biomass would occur regardless of the proposed biomass project"). This not only defies economic logic but also contradicts the goals of the Bioenergy Action Plan. Indeed, one major purpose of that plan is to use bioenergy facilities to make forest thinning operations more economically practicable; thus new biomass facilities are specifically intended to facilitate the harvest and removal of woody biomass which would not have been economical—and thus would *not* have occurred—without the proposed biomass project.[14] The creation of economic incentives to conduct additional logging and forest thinning operations must be analyzed in the EA. *See, e.g.*, *California Unions for Reliable Energy v. Mojave Desert Air Quality Mgmt. Dist.*, 178 Cal. App. 4th 1225 (2009). Absent such analysis, the EA's conclusion that disposal of woody biomass at bioenergy facilities "would not have a substantial, long-term effect on forest resources," EA at 57, lacks any evidentiary basis.

5-4 cont'd

The EA's proposed mitigation measures are also inadequate. The EA acknowledges that forest resource impacts from bioenergy expansion are potentially significant, and claims they could be mitigated to a less-than-significant level, but then argues that all such mitigation is "beyond the authority of the ARB and not within its purview." EA at 57. Mitigation measure 2.f, for example, simply refers back to

[12] TSS Consultants, *Fuel Procurement Plan for the Lake Tahoe Basin Biomass Power Facility* 13 (Feb. 26, 2011) (attached as Ex. 2).

[13] Bioenergy Action Plan at 17 (identifying necessity of "safeguards to protect and restore ecosystem health"); Proposed First Update App. C, Energy Working Paper at 57 (recommending that state develop "a uniform state sustainable forest biomass usage policy" to reduce impacts from increased utilization).

[14] Id. at 6. 9 (discussing ways in which new bioenergy facilities, if able to charge enough for electricity generated, could lead to thousands of acres of additional forest treatment).

mitigation measure 2.a, which says only that other agencies will follow applicable laws and conduct CEQA reviews for future projects. *See* EA at 51-52, 57-58.

This is insufficient. An agency may disclaim responsibility for mitigation measures only if they are exclusively the responsibility of other agencies. *City of Marina v. Board of Trustees of California State University*, 39 Cal. 4th 341, 366 (2006). Moreover, even in a programmatic environmental document, a lead agency has the responsibility to evaluate feasible mitigation measures that *are* under its control. *See* CEQA Guidelines § 15168(b)(4), (c)(3). The EA fails to identify any feasible mitigation measures that are within ARB's "purview," such as delaying efforts to expand biomass facilities as called for in the Bioenergy Action Plan until the state develops forest sustainability criteria and other environmental safeguards. These safeguards, moreover, are not solely the responsibility of other agencies, but rather are at least partly ARB's responsibility. The Bioenergy Action Plan explicitly tasked various agencies with developing standards to ensure the sustainability of increased biomass harvests and harvest practices.[15] ARB was listed as a supporting and participating agency in this context, particularly in light of ARB's authority over the LCFS program, which will rely heavily on biofuels.[16] ARB cannot simply push these responsibilities onto other agencies. 5-4 cont'd

Finally, the EA's "conservative" conclusion that impacts will be significant and unavoidable, EA at 58, lacks support. The conclusion may or may not be conservative, but absent adequate analysis of impacts and consideration of mitigation measures, it is also a legally impermissible shortcut. *Berkeley Keep Jets Over the Bay Comm. v. Bd. of Port Comm'rs*, 91 Cal.App.4th 1344, 1371 (2001) (agency may not "travel the legally impermissible easy route to CEQA compliance" by making a significance determination without fully analyzing a project's effects).

Cap-and Trade Sector

The discussion of cap-and-trade sector actions and responses entirely fails to disclose or analyze any potential effects of recommendations that ARB adopt additional offset protocols for "biomass." EA at 26. This omission results in inadequate disclosure and analysis of the possible effects of recommended cap-and-trade sector actions.

B. Air Quality 5-5

Energy Sector

The EA's analysis and conclusions regarding potential air quality impacts from energy sector recommendations and compliance actions are inadequate.

[15] Id. at 20-21.
[16] Id.

The EA acknowledges that new renewable energy projects could be built in response to the Proposed First Update, but claims that these facilities "could result in an indirect emission reduction by displacing emissions associated with fossil-fuel fired power plant electricity generation that otherwise would occur. Thus, implementing such actions could also be beneficial to air quality conditions through replacement of coal, or other fossil-fueled power plants." EA at 64. Bioenergy facilities are not mentioned, but as discussed below (under the natural and working lands sector), these facilities may have substantially higher criteria pollutant emissions than gas-fired and even coal-fired facilities.[17]

The EA states that unspecified types of renewable energy facilities may have potential criteria and hazardous air pollutant ("HAP") emissions, but then concludes that following project-level review and mitigation, none of these sources would have emissions above applicable significance thresholds. EA at 64-65. Accordingly, the EA concludes that operational emissions will be less than significant. *Id.* There is no evidentiary basis for this claim, and in fact the evidence strongly points in the opposite direction. Significance thresholds—especially in areas of California that already experience poor air quality—are quite stringent. For example, in the San Joaquin Valley Air Pollution Control District, the emission of 10 tons per year of NOx or reactive organic gases is considered significant.[18] A draft update to these thresholds published in 2012 would consider 15 tons per year of PM2.5 or PM10 significant.[19] A wide range of facilities could easily exceed these thresholds. Moreover, nothing in CEQA requires a project's effects to be mitigated to a level of insignificance, provided all other applicable legal requirements are satisfied. PRC 21081(a)(3), (b). There is no basis for the EA's conclusion that the air quality impacts of all conceivable renewable energy facilities will be less than significant. 5-5 cont'd

Waste Management Sector

The EA completely fails to disclose or analyze any potential air quality impacts of increased municipal solid waste ("MSW") conversion, transformation, and incineration, even though expanding waste-to-energy technologies and utilization are explicit goals of the First Proposed Update (at 75), Bioenergy Action Plan (at 21), and the Waste Management Working Paper (*passim*). Instead, the EA discloses only that the Proposed First Update could lead to construction of new anaerobic digesters and composting 5-6

[17] Without explanation, the EA seems to split discussion of the impacts of renewable energy facilities in two, with bioenergy facilities discussed variously under the natural and working lands, agriculture, and waste management sectors, and other facilities discussed under the energy sector. This is needlessly confusing and does not contribute to meaningful public understanding of the impacts at issue.

[18] San Joaquin Valley Air Pollution Control District, *Guide for Assessing and Mitigating Air Quality Impacts* 26 (Table 4-1) (Jan. 2002) (attached as Ex. 3).

[19] San Joaquin Valley Air Pollution Control District, *Draft Guidance for Assessing and Mitigating Air Quality Impacts* 84 (Table 6) (April 2012) (attached as Ex. 4).

facilities, and fails to mention the conventional waste combustion, gasification, pyrolysis, and plasma arc technologies discussed throughout the Waste Management Working Paper. This failure to disclose and analyze a substantial aspect of the project under consideration violates CEQA as a matter of law.

The EA's significance conclusions also lack support. As in its energy sector analysis, the EA states that because individual facilities would have to obtain permits and go through CEQA review, there would be no emissions above significance thresholds from any facility, and that overall impacts would therefore be less than significant. EA at 71-72. There is no legal or evidentiary basis for this conclusion. Emissions from waste-to-energy facilities—particularly large facilities burning biomass materials, plastics, and other municipal waste—easily could easily exceed the significance thresholds discussed above. Again, nothing in CEQA requires a project to be mitigated to a level of insignificance, provided all other applicable legal requirements are satisfied. § 21081(a)(3), (b). The EA's conclusions regarding the significance of air quality impacts cannot be supported. 5-6 cont'd

Natural and Working Lands Sector

The EA acknowledges that construction and operation of new biomass facilities could have significant air quality impacts. EA at 75-77. The analysis, however, lacks detail essential to public and decision-maker understanding of the scale and severity of these impacts. The document's mitigation measures and significance conclusions also lack legal and factual support.

Bioenergy facilities are significant sources of conventional air pollutants. For example, a PSD permit evaluation for a new 31-MW biomass power plant proposed by Sierra Pacific Industries in Anderson, California, shows the following potentials to emit for criteria pollutants: CO at 472 tpy, NOx at 267 tpy, PM10 and PM2.5 at 42.1 tpy, and VOCs at 34.9 tpy.[20] Indeed, a recent study of 88 air permits for bioenergy facilities shows that permitted criteria air pollutant emission rates for biomass facilities typically exceed those for coal facilities on a lbs/MWh basis, and vastly exceed those for NG facilities ("by more than 800% for every major pollutant").[21] For every megawatt of bioenergy that displaces a megawatt of conventional (largely gas-fired) generation in California, therefore, criteria pollutant and HAP emissions will likely increase. The EA must be revised to consider these impacts on air quality in light of the expansion of biomass operations recommended in the Proposed First Update and the documents on which it relies. 5-7

[20] USEPA Region IX, *Statement of Basis and Ambient Air Quality Impact Report, Sierra Pacific Industries—Anderson*, Permit No. SAC 12-01 at 9 (Sept. 2012) (attached as Ex. 5).
[21] Mary S. Booth, Ph.D., *Trees, Trash, and Toxics: How Biomass Energy Has Become the New Coal* 5 (April 2, 2014) (attached as Ex. 6).

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The EA in this section also once again improperly disclaims ARB's responsibility for mitigation. As discussed above, ARB is designing the Proposed First Update and helping to pursue a Bioenergy Action Plan intended to aggressively increase biomass use. ARB could change that plan to rely less on renewable energy sources that may cause even more air pollution than the fossil sources they are meant to displace. Once again, the EA cannot avoid CEQA's requirements for adequate disclosure and analysis, and disclaim ARB's responsibility for mitigation, by simply asserting that impacts will be significant and unavoidable. *Berkeley Keep Jets Over the Bay Committee*, 91 Cal.App.4th at 1371. 5-7 cont'd

C. Greenhouse Gases

Energy Sector

The EA's conclusion that long-term greenhouse gas impacts from the energy sector will be beneficial (EA at 126) is not supported by adequate analysis or evidence.

The EA states that carbon capture and sequestration ("CCS") facilities could be built in response to the Proposed First Update. EA at 124. The EA's project description section acknowledges that CCS could be used for enhanced oil recovery ("EOR"), EA at 15, 18, but the environmental impact section does not address this possibility. *See* EA at 125-26. The EA thus omits discussion of the potentially significant greenhouse gas emissions that could result from combustion of the oil developed from EOR operations. 5-8

Indeed, the indirect emissions resulting from EOR could exceed the volume of CO_2 stored. According to a recent National Energy Technology Laboratory/Department of Energy report, 67.2 billion barrels of oil could become economically recoverable nationwide using "next generation" EOR technology.[22] Recovering this amount of oil would require 17.6 billion metric tonnes ("Gt") of CO_2 from anthropogenic (i.e., industrial) sources.[23] Using an EPA emission factor of .43 metric tonnes CO_2 per barrel of oil,[24] consumption of 67.2 billion barrels of otherwise unproduced oil would result in emissions of 28.9 Gt CO_2—11.3 Gt more CO_2 than would be captured from industrial sources and sequestered in the course of producing the oil. This is obviously a rough comparison that assumes (a) permanent and complete sequestration of all injected CO_2 following oil production and (b) that the oil otherwise could not and would not be produced using another method (i.e., that it would "stay in the ground"). It nonetheless points to the potentially significant *increase* in greenhouse gas emissions that could result

[22] U.S. Dept. of Energy and Nat'l Energy Tech. Laboratory, *Improving Domestic Energy Security and Lowering CO_2 Emissions with Next Generation CO_2-Enhanced Oil Recovery (CO_2-EOR)* 10 (June 20, 2011), *available at* www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/DOE-NETL-2011-1504-NextGen_CO2_EOR_06142011.pdf (accessed April 28, 2014).
[23] Id.
[24] U.S. EPA, Calculations and References, *at* http://www.epa.gov/cleanenergy/energy-resources/refs.html (accessed April 28, 2014).

from this use of CO_2. Depending on how much CO_2 is captured and used for EOR, any emissions reductions achieved by CCS could be cancelled out, or even exceeded, by CO_2 emissions from the resulting oil production. The EA fails even to acknowledge, much less to consider the significance of, this potential impact.

The EA also assumes that any electricity generation qualifying as "renewable" will reduce GHG emissions. EA at 126. As described in the Center's comments on the Discussion Draft, this is not true of bioenergy, which is substantially more carbon-intensive than other renewables and even than fossil fuels.[25] The EA's conclusions regarding the impact of GHG emissions from this sector thus further lack support. 5-8 cont'd

Recent research is also showing that cellulosic biofuels of the kind that will be necessary to fulfill expanded LCFS mandates, whether made from agricultural residue or woody materials, may not be effective in reducing GHG emissions, at least not in the time frame relevant for consideration under AB 32 and Executive Order S-3-05.[26] Other studies have pointed out the importance of considering direct and indirect land use change in evaluating the overall GHG impacts of biofuels production and use.[27] The EA must be revised to consider the expanded use of biofuels under the Proposed First Update and the likely effect on GHG emissions in light of current scientific understanding.

Agriculture Sector

Rather than considering the effects of increased biofuels usage in the transportation sector—where one might expect to find impacts related to expanding the LCFS—the EA cursorily addresses these effects in the agriculture sector. Wherever the analysis appears, it is insufficient.

The EA properly acknowledges that "[d]epending on the feedstock and production process and time horizon of the analysis, biofuels can emit even more GHGs than some fossil fuels on an energy-equivalent basis." EA at 128. Yet the EA fails to address the significance of this acknowledgment. Instead, the EA simply dismisses the impact: "[B]ecause the Proposed Update would include research and coordination between State, local, and national conservation programs to reduce GHG emission reductions [*sic*], the recommendations under the Agriculture Sector would result in reduced GHG emissions." *Id.* From this, the EA concludes that impacts associated with 5-9

[25] Discussion Draft Comments at 4-5; *see also* Comments of the Center for Biological Diversity on the 2013 AB 32 Scoping Plan Update (Aug. 5, 2013) (attached as Ex. 7).
[26] See, e.g., Adam Liska, et al., *Biofuels from Crop Residue Can Reduce Soil Carbon and Increase CO_2 Emissions*, Nature Climate Change (April 20, 2014), DOI: 10.1038/NCLIMATE2187 (attached as Ex. 8); Jon McKechnie, et al., *Forest Bioenergy or Forest Carbon? Assessing Trade-Offs in Greenhouse Gas Mitigation with Wood-Based Fuels*, 45 Environ. Sci. Technol. 789 (2011) (attached as Ex. 9 to Discussion Draft Comments).
[27] *See, e.g.*, Jerry M. Melillo, et al., *Indirect Emissions from Biofuels: How Important?* ScienceExpress 10.1126/science.1180251 (Oct. 22, 2009) (attached as Ex. 9).

the Agriculture sector will be beneficial. *Id.* Yet the EA fails to explain how unspecified "coordination" efforts among unidentified "conservation programs" to "reduce GHG emission reductions" will ensure that potential *increases* in emissions relative to fossil fuels somehow actually turn out to be *reductions*. The EA identifies no evidence in support of this conclusion.

In any event, CEQA does not permit an agency to identify an impact, and then to dismiss it based on vague promises of future "research and coordination." Having acknowledged that biofuels may increase GHG emissions, and may have other undesirable environmental effects (EA at 128), ARB must "do more than agree to a future study of the problem." *California Clean Energy Committee v. City of Woodland*, __ Cal.App.4th __, 2014 Cal. App. LEXIS 300, 38 (Cal. App. 3d Dist. Feb. 28, 2014). Nor does the "programmatic" nature of the EA excuse ARB from at least attempting to provide some meaningful analysis here. "While proper tiering of environmental review allows an agency to defer analysis of certain details of later phases of long-term linked or complex projects until those phases are up for approval, CEQA's demand for meaningful information 'is not satisfied by simply stating information will be provided in the future.'" *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova*, 40 Cal. 4th 412, 431 (2007) (quoting *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal.App.4th 715, 723). 5-9 cont'd

Waste Management Sector

Once again, this section of the EA fails to disclose or analyze the increased use of waste-to-energy technologies envisioned in the Proposed First Update, the Bioenergy Action Plan, and the Waste Management Working Paper. *See* EA at 130. Absent such disclosure and analysis, there is no support for the EA's conclusion that impacts will be beneficial.

The documents underlying the Proposed First Update also contain serious errors that further undermine the EA's analysis. The Waste Management Working Paper, for example, states that "only the emissions from combustion of nonbiogenic material (such as fossil fuels) are counted as GHG emissions that contribute to climate change per protocols established by the Intergovernmental Panel on Climate Change (IPCC)."[28] On this basis the Working Paper concludes that "California biomass conversion operations result in net negative GHG emissions. While these facilities result in direct GHG emissions (mostly as carbon dioxide) when biomass is burned, the majority of these emissions are biogenic, and not counted as discussed above."[29] On the basis of this assumption, the Working Paper goes so far as to conclude that the more biomass facilities built, the greater the reduction in overall GHG emissions. 5-10

[28] Waste Mgt. Working Paper at 75; see also id. 88 (repeating same error in discussion of GHG emissions from conversion of biogenic fraction of MSW).
[29] Id. at 76.

As discussed in the Center's comments on the Discussion Draft, these conclusions are based on a demonstrably erroneous interpretation of IPCC guidelines—one now expressly disavowed by both the IPCC and EPA, and one that has no basis in physical science.[30] Accordingly, this erroneous interpretation cannot constitute substantial evidence in support of any conclusion in the EA. CEQA Guidelines § 15384(a) ("evidence which is clearly erroneous or inaccurate . . . does not constitute substantial evidence").

5-10 cont'd

The Bioenergy Action Plan also suggests that combustion of urban-derived lumber will avoid GHG emissions, particularly methane emissions, associated with landfill disposal of that material.[31] Large woody materials, however, tend to stay sequestered in landfills and do not generate much, if any, methane.[32] While landfill diversion and the reduction of landfill methane emissions are very important goals, increasing combustion of urban-derived wood for bioenergy may have the effect of increasing rather than reducing GHG emissions. To the extent that the Proposed First Update incorporates efforts to increase combustion of urban-derived waste wood, the EA must accurately assess the environmental impact of these efforts.

Natural and Working Lands Sector

This section of the EA contains serious errors, and contradicts other sections of the EA and the white papers supporting the Proposed First Update.Chief among these errors is the claim that combustion of biomass is "'carbon neutral' by virtue that the CO2 emissions are already part of the carbon cycle." EA at 131.

The blanket assumption that biomass combustion is *a priori* "carbon neutral" has no factual support, as described in our comments on the Discussion Draft.[33] The "natural carbon cycle" theory of carbon neutrality in particular is entirely unsupported and demonstrably incorrect. Reducing terrestrial carbon stocks results in a transfer of carbon to the atmosphere. While trees, plants, and soils may not store carbon for as long as fossil fuel materials, trees and soils in particular can store that carbon for periods of time relevant to climate mitigation efforts—and certainly for periods of time relevant to California's 2020 and 2050 emission reduction goals. When that carbon is in terrestrial stocks, it is not exerting a warming effect on the atmosphere. When that carbon is oxidized to CO_2, however, it does exert a warming effect on the atmosphere. The atmosphere cannot tell the difference between a molecule of biogenic CO_2 and a molecule of fossil CO_2.[34] Both trap heat for as long as they remain in the atmosphere.

5-11

[30] Discussion Draft Comments at 8-9, nn. 17-19, & Ex. 6, 14-16.
[31] Bioenergy Action Plan at 14.
[32] J. A. Micales & K. E. Skog, *The Decomposition of Forest Products in Landfills*, 39 International Biodeterioration & Biodegradation 145 (1997) (attached as Ex. 10).
[33] Discussion Draft Comments at 5-7, nn. 11-15, & Ex. 6-12.
[34] Science Advisory Board Review of EPA's Accounting Framework for Biogenic CO2 Emissions from Stationary Sources 7 (Sept. 28, 2012) (hereafter "SAB Panel Report")

Indeed, taken to its logical extreme, the "natural carbon cycle" theory would lead to the absurd conclusion that deforestation has no effect on climate change. Under a literal application of this theory, every single tree, shrub, and blade of grass on Earth could be burned tomorrow and converted into CO_2 with no discernible effect on the climate.

Scientists and policy-makers agree, however, that deforestation—which necessarily entails conversion of sequestered biogenic carbon into atmospheric CO_2—does contribute to climate change. Ten to 15 percent of global carbon emissions result from deforestation and forest degradation, primarily in the tropics.[35] These emissions are estimated at between 1,400 and 2,000 Tg per year.[36] Although U.S. forests are generally considered a net carbon sink, this may be true only due to significant global leakage related to domestic demand for wood and agricultural products.[37] The United States has also experienced the greatest loss of forest cover, as a proportion of forest cover in the year 2000, of any country with more than one million square kilometers of forest.[38] GHG emissions associated with these losses are significant contributors to climate change notwithstanding their "biogenic" character.[39] By the same token, a wide-scale shift to woody biomass energy generation could result in conversion of nearly all of the world's unmanaged forests and much of its pastureland to energy plantations.[40]

5-11 cont'd

The "natural carbon cycle" theory also ignores the fact that a tremendous amount of primary forest, representing a huge proportion of historic biogenic carbon stores, has been lost during the last few centuries. According to recent maps compiled by the World Resources Institute, only 21 percent of the world's forests are "intact," and 47 percent have been lost entirely.[41] Between 1850 and 2000, global land use change caused emissions of 156,000 Tg of carbon, mostly from deforestation.[42] Recent studies indicate

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(attached as Ex. 6 to Discussion Draft Comments); *Center for Biological Diversity v. EPA*, 722 F.3d 401, 406 (D.C. Cir. 2013) ("In layman's terms, the atmosphere makes no distinction between carbon dioxide emitted by biogenic and fossil-fuel sources").

[35] *See* Gregory P. Asner, et al., *High-Resolution Forest Carbon Stocks and Emissions in the Amazon*, Proc. Nat'l Academy of Sci. Early Edition (2010) (attached as Ex. 11).

[36] Michael G. Ryan, et al., *A Synthesis of the Science on Forests and Carbon for U.S. Forests*, Ecological Society of America: Issues in Ecology, Report No. 13 (Spring 2010) at 5 (attached as Ex. 12).

[37] *Id.* at 5-6.

[38] Matthew C. Hansen, et al., *Quantification of Global Gross Forest Cover Loss*, 107 Proc. Nat'l Academy of Sci. 8650 (May 11, 2010) (attached as Ex. 13).

[39] *See* Eric Johnson, *Goodbye to Carbon Neutral: Getting Biomass Footprints Right*, 29 Envtl. Impact Assessment R. 165 (2008) (attached as Ex. 14).

[40] *See* Marshall Wise, et al., *Implications of Limiting CO_2 Concentrations for Land Use and Energy*, 324 Science 1183 (2009) (attached as Ex. 15).

[41] World Res. Inst., State of the World's Forests (Jan. 8, 2009), *at* http://www.wri.org/resource/state-worlds-forests (accessed April 28, 2014).

[42] Ryan 2010, *supra* note 36 at 6.

that the density of remaining forest cover may be lower and far more variable than previously thought.[43] This historic and continuing loss of forest biomass—much of which has been burned or otherwise converted into atmospheric carbon pollution—represents a tremendous existing carbon debt, one that further emissions of biogenic carbon can only increase. To extend the debt metaphor, continuing to burn trees for energy isn't like balancing a checkbook. It's like taking out another mortgage on a house that's already far underwater.

In support of this thoroughly discredited assertion, the EA cites CEQA review documents for three biomass facilities. However, neither the EIR for the Buena Vista facility nor the EIR for the Placer County facility even made the assumption that biomass combustion is "carbon neutral," much less that it is carbon neutral because biogenic CO_2 is "part of the carbon cycle." Although the final version of the EIR for the Sierra Pacific Industries Anderson facility did ultimately assume that biomass combustion was "carbon neutral," it did so only after having assumed in prior versions of the document that it was not. And in any event, after a federal court invalidated EPA's unlawful exemption of biogenic CO_2 from Clean Air Act permitting requirements, *Center for Biological Diversity v. EPA*, 722 F.3d 401 (D.C. Cir. 2013), Sierra Pacific Industries submitted a PSD permit to EPA Region IX acknowledging that the facility will emit 432,439 tons CO_2-equivalent (including 423,526 tons of CO_2, nearly all of it biogenic) every year.[44] Nothing cited in the EA provides any support at all for the assertion that biomass combustion is "carbon neutral" because the CO_2 released is part of a "natural carbon cycle." 5-11 cont'd

The EA also asserts that "[a] modeling study by the California Energy Commission suggests that biomass power facilities that consume hazardous fuels removed from forests provide a GHG benefit over time because the thinned forests are less likely to become subject to more intense, catastrophic, GHG-emitting wildfires." EA at 133. The Natural and Working Lands Working Paper similarly asserts that "[t]he near-term carbon emissions associated with the thinning can be reduced if the waste material is used at a local biomass facility to generate energy."[45] As a threshold matter, these assertions serve to underscore the EA's inconsistent deployment of the "natural carbon cycle" theory. If bioenergy emissions are part of a natural carbon cycle that has no effect on the atmosphere, there is no reason to count reductions or offsets of wildfire emissions, because those emissions are also part of the same "natural carbon cycle." The EA cannot have it both ways.

In any event, several other studies—including peer-reviewed, published studies and one additional study funded by the Energy Commission itself—have concluded that

[43] *See* Asner 2010, *supra* note 35.
[44] USEPA Region IX, *Supplemental Statement of Basis and Ambient Air Quality Impact Report for Greenhouse Gas Emissions, Sierra Pacific Industries—Anderson*, PSD Permit No. SAC 12-01 at 12 (Table 3-3) (November 2013) (attached as Ex. 16).
[45] Natural and Working Lands Working Paper at 15.

forest thinning treatments nearly always result in greater losses of carbon stocks (and greater atmospheric emissions) than they avoid in wildfire emissions.[46]

Finally, the EA's assertion that biomass combustion is "carbon neutral" because the CO_2 released is part of the "natural carbon cycle" flatly contradicts other assertions in the EA and accompanying white papers. The acknowledgment in the agriculture sector discussion that biofuels can emit more GHGs than fossil fuels depending on feedstock (EA at 128) is a case in point, as is the Energy White Paper's recognition that "[f]urther work is needed to analyze existing state and federal forest and wildland protections to ensure that biomass use will not increase net long-term GHG emissions."[47] It is irrational and arbitrary for the EA to deploy multiple, contradictory rationales for its conclusions. As a result, the conclusion that the expansion of bioenergy envisioned in the SPU and BAP will have a less than significant impact is misleading and lacks evidentiary support. 5-11 cont'd

IV. The EA Fails to Consider Feasible Alternatives Within ARB's Control that Could Alleviate Significant and Potentially Significant Environmental Impacts

Given the risk that increasing reliance on bioenergy may increase GHG and criteria pollutant emissions, while also increasing impacts to forests and habitat, the EA should articulate an alternative that delays implementation of aggressive expansion of bioenergy pending completion of the study and analysis recommended in portions of the documents. Absent this analysis, the EA cannot conclude that the proposed project is better at meeting stated objectives (particularly objectives 1, 2, 3, 6, 9, and 10, EA at 251-52) than an alternative that does not rely on bioenergy expansion. 5-12

V. Conclusion

For the foregoing reasons, the EA does not comply with CEQA. A revised EA must be prepared and recirculated for comment before ARB can lawfully approve the Proposed First Update.

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[46] See Discussion Draft Comments at 10-12; Stephen R. Mitchell, et al., *Carbon debt and carbon sequestration parity in forest bioenergy production*, Global Change Biology Bioenergy (2012), doi:10.1111/j.1757-1707.2012.01173.x (attached as Ex. 7 to Discussion Draft Comments); John L. Campbell, et al., *Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions?* Front. Ecol. Env't (2011), doi:10.1890/110057 (attached as Ex. 17 to Discussion Draft Comments); Tara Hudiburg, et al., *Regional carbon dioxide implications of forest bioenergy production*, Nature Climate Change (2011), doi: 10.1038/NCLIMATE1264 (attached as Ex. 18 to Discussion Draft Comments); T.R.H. Pearson, et al., *Emissions and potential emission reductions from hazardous fuel treatments in the WESTCARB region*, California Energy Commission (2010) (attached as Ex. 17).

[47] Energy Working Paper at 57.

California Air Resources Board
Re: Draft EA for the Proposed First Update to the Climate Change Scoping Plan
April 28, 2014

Thank you for your consideration of these comments. We would be happy to meet at your convenience to discuss our comments and the supporting documents. We look forward to working with ARB to address these issues in the EA and the Proposed First Update. 5-12 cont'd

Sincerely,

Kevin P. Bundy
Senior Attorney

Encl.: Exhibits 1-17 (uploaded as zipped PDF files; see attached list)

California Air Resources Board
Re: Draft EA for the Proposed First Update to the Climate Change Scoping Plan
April 28, 2014

List of Exhibits
(Submitted via internet upload in PDF format)

Exhibit	Title
1	Bioenergy Interagency Working Group, 2012 Bioenergy Action Plan (Aug. 2012).
2	TSS Consultants, *Fuel Procurement Plan for the Lake Tahoe Basin Biomass Power Facility* (Feb. 26, 2011).
3	San Joaquin Valley Air Pollution Control District, *Guide for Assessing and Mitigating Air Quality Impacts* (Jan. 2002).
4	San Joaquin Valley Air Pollution Control District, *Draft Guidance for Assessing and Mitigating Air Quality Impacts* (April 2012).
5	USEPA Region IX, *Statement of Basis and Ambient Air Quality Impact Report, Sierra Pacific Industries—Anderson*, Permit No. SAC 12-01 (Sept. 2012).
6	Mary S. Booth, *Trees, Trash, and Toxics: How Biomass Energy Has Become the New Coal* (April 2, 2014).
7	Comments of the Center for Biological Diversity on the 2013 AB 32 Scoping Plan Update (Aug. 5, 2013).
8	Adam Liska, et al., *Biofuels from Crop Residue Can Reduce Soil Carbon and Increase CO_2 Emissions*, Nature Climate Change (April 20, 2014), DOI: 10.1038/NCLIMATE2187.
9	Jerry M. Melillo, et al., *Indirect Emissions from Biofuels: How Important?* ScienceExpress 10.1126/science.1180251 (Oct. 22, 2009).
10	J. A. Micales & K. E. Skog, *The Decomposition of Forest Products in Landfills*, 39 International Biodeterioration & Biodegradation (1997).
11	Gregory P. Asner, et al., *High-Resolution Forest Carbon Stocks and Emissions in the Amazon*, Proc. Nat'l Academy of Sci. Early Edition (2010).
12	Michael G. Ryan, et al., *A Synthesis of the Science on Forests and Carbon for U.S. Forests*, Ecological Society of America: Issues in Ecology, Report No. 13 (Spring 2010).
13	Matthew C. Hansen, et al., *Quantification of Global Gross Forest Cover Loss*, 107 Proc. Nat'l Academy of Sci. 8650 (May 11, 2010).
14	Eric Johnson, *Goodbye to Carbon Neutral: Getting Biomass Footprints Right*, 29 Envtl. Impact Assessment R. 165 (2008).
15	Marshall Wise, et al., *Implications of Limiting CO_2 Concentrations for Land Use and Energy*, 324 Science 1183 (2009).
16	USEPA Region IX, *Supplemental Statement of Basis and Ambient Air Quality Impact Report for Greenhouse Gas Emissions, Sierra Pacific Industries—Anderson*, PSD Permit No. SAC 12-01 at 12 (Table 3-3) (November 2013)
17	T.R.H. Pearson, et al., *Emissions and potential emission reductions from hazardous fuel treatments in the WESTCARB region*, California Energy Commission (2010).

Comment Letter 5 Response

5-1 This portion of the comment letter provides an introduction and general comments about the EA, with more detailed comments provided later in the body of the letter. See response to comments 5-2 through 5-12 for the more detailed responses.

5-2 This portion of the comment cites various requirements that the commenter asserts apply to ARB's certified regulatory program and case law regarding preparing CEQA-based documents. The EA prepared by ARB for the Update provides an accurate project description, disclosure of potentially significant indirect environmental impacts for the reasonably foreseeable compliance responses associated with implementation of the recommended actions in the Update, and a discussion of feasible alternatives, mitigation measures, and cumulative impacts. It provides as much information as reasonably can be provided at this level of planning and sufficiently informs the public and decision-makers of the potential indirect environmental effects associated with the project as required by CEQA.

The commenter incorrectly suggests that ARB has deferred the environmental analysis and does not provide sufficient detail for a program-level analysis. While the commenter states the "advantages" of using a programmatic document (Cal. Code Regs., tit. 14, §15168(b)), the commenter does not acknowledge that the level of detail in a program-level document need not be greater than that of the program being analyzed. (Cal. Code Regs., tit. 14, § 15152(b).) The level of detail in the Draft EA reflects that the project is a broad plan with recommendations that are not fully defined at this time. Consequently, the analysis does not, and cannot, provide the level of detail that will be provided in subsequent environmental documents prepared for specific regulatory or non-regulatory actions to reduce GHG emissions that ARB or other agencies may pursue.

Finally, the commenter states that programmatic documents are not exempt from CEQA's requirement that public agencies adopt all feasible mitigation measures. The impact discussion includes, where relevant, construction-related effects, operational effects of new or modified facilities, and analysis of the recommended actions on GHG and air pollutant emissions. Because the specific location, extent, and design of potential new and/or modified facilities that may be constructed in response to implementation of the recommended actions in the Update cannot be known at this time, the EA's discussion of these impacts is necessarily generalized and reflects a conservative assessment to describe the type and magnitude of effects that may occur (i.e., conservative in that the conclusions tend to discuss the potential adverse effects related to a worst-case scenario). These impact discussions are followed by the types of mitigation

measures that could typically be required to reduce potentially significant environmental impacts. This EA takes a conservative approach in finding some impacts to be potentially significant after mitigation because the authority to determine project-level impacts and require project-level mitigation lies with the land use and/or permitting agency for individual projects, and because the programmatic level of analysis associated with this EA does not attempt to address project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation that may ultimately be implemented to reduce potentially significant impacts. This conservative approach (i.e., tending to overstate environmental impacts) is intended to satisfy the good-faith, full-disclosure intent of CEQA (page 4 of the Draft EA) and sufficiently informs the public and decision-makers.

5-3 The commenter asserts the project description does not meet CEQA's requirements "largely because the recommended actions and compliance responses discussed in the project description do not fully reflect proposals in the Proposed First Update or the accompanying technical 'working papers'." As stated in the EA's Project Description, Section 2.0, ARB considers the recommended actions for each of the nine sectors discussed in the Update as the "project" under CEQA. The recommendation boxes from the Update are reproduced in the Project Description section of the EA. The EA focuses on reasonably foreseeable compliance responses associated with the recommended actions and not the other strategies, objectives, and recommendations in each of the "focus area working papers" or other referenced documents because not all of the strategies, objectives, and recommendations in those documents were incorporated into the Update. As described in the Update (see *Process for Developing the Update*), the working papers developed for the six focus areas were designed to inform and guide the policy recommendations and program priorities for the Update. Not all of the recommended actions developed for the "focus area working papers" are carried over into the Update as "key recommended actions" for the various sectors.

The Update also references the strategies, goals, objectives, and actions set forth in relevant cited State documents (such as the 2012 Bioenergy Action Plan developed by the CEC). However, the Update does not adopt or incorporate all those proposed policies or actions because not all of the policies or actions within these documents directly relate to the Update's underlying objective of achieving GHG emission reductions or because they may conflict with the "key recommended actions" set forth in the Update or other State environmental objectives.

Pages 4 and 5 of this comment letter's notes that the Update includes recommendations to extend and strengthen the Low Carbon Fuel Standard (LCFS), which potentially would include an expanded role for biofuels consistent with the Bioenergy Action Plan. The letter also refers to Page 70, which contains an agricultural sector policy to promote the input of digester biogas into pipelines

and bioenergy onto the electricity grid. The commenter asserts that the Draft EA, however, does not identify any anticipated level of biofuels expansion as part of the proposed project. The Draft EA addresses the potential for the development of biomass facilities for purposes of producing electricity and transportation fuels within the Natural and Working Lands section of the document—see pages 75 and 131 relative to Air Quality and Greenhouse Gas impacts, respectively.

With regard to the potential expansion of the LCFS, that program is a performance-based regulation that does not prescribe specific fuels for compliance and, therefore, does not promote the development of any particular fuel. That being said, ARB sees tremendous opportunity for the use of biomethane as an ultra-low-carbon intensity (CI) fuel. Such biomethane can come from dairy digesters, landfills, wastewater treatment plants, and anaerobic digesters that use landfill-diverted food and green wastes as a feedstock. Furthermore, the biomethane for transportation purposes could be produced in lieu of on-site electricity production at existing dairy digesters and wastewater treatment plants, and in lieu of flaring at landfills.

Finally, cellulosic biofuels using woody biomass, may or may not be produced in California, depending on the costs of production. Finding a constant 20-year feedstock supply within 50 miles of a prospective biofuel plant is a particular challenge, as occasional forest-thinning or orchard removal activities would not provide a reliable feedstock supply. A Draft EA for proposed amendments to the LCFS, which will evaluate GHG emissions, is currently under development and is anticipated to be release later this year with that proposal.

Page 5 of the comment letter indicates “the waste management section of the project description does not mention any increase in combustion of municipal solid waste (MSW) and biomass, both of which may result in GHG and other air pollutant emissions.” The letter references pages 24 – 27 of the Draft EA. Page 5 of this comment letter states: “Yet the proposed update includes expansion of MSW thermal operations (waste to energy) and biomass management….” Page 75 of the Update identifies MSW waste-to-energy projects as a component of the existing Waste Management Sector, and page 76 notes that various State agencies are evaluating emission reduction options within the waste management sector, including waste-to energy projects. However, the Key Recommended Actions for the Waste Sector on Page 78 of the Update do not call for the development of new or expansion of existing MSW waste-to energy facilities. Thus, the proposed project does not include a recommendation to increase the combustion of MSW and analysis of the potential impacts is not required.

Page 5 of this comment letter indicates “the EA’s description of compliance responses, however, only refers to new or expanded composting and anaerobic digestion facilities—not new or expanded biomass conversion or waste to energy facilities—and makes only oblique references to new offset protocols for

biomass." The letter references page 26 of the Draft EA. The proposed project does not include a recommendation to increase the combustion of MSW so an analysis of the potential impacts was not required. The "compliance responses" paragraph on page 26, however, does refer to the possibility of new or expanded biomass facilities: "These facilities would be necessary to accommodate actions such as increased recycling, development of biomass facilities, and anaerobic digestion facilities." In addition, page 28 of the Draft EA, relative to the Natural and Working Lands Sector, also identifies increased use of biomass facilities to produce electricity and transportation fuels as a potential compliance response.

The Update and the Draft EA's reference to offset protocols for recycling, composting, anaerobic digestion and biomass in the table of Key Recommended Actions for the Waste Sector has been modified in the final version of the Update released May 15, 2014. While ARB will explore the potential for offset protocols in the waste sector, ARB does not plan to develop a biomass waste-to-energy offset protocol for the Cap-and-Trade Program. Energy is a capped sector and only GHG reductions in sectors not covered by the program are eligible for offset credits. Please see the following link for the criteria for development of compliance offset protocols for the Cap-and-Trade Program: http://www.arb.ca.gov/cc/capandtrade/compliance-offset-protocol-process.pdf

5-4 The comment expresses concern related to the potential scale and extent to which biomass facilities could be constructed and operated based on the Update's recommended action that "[t]he Bioenergy Interagency Working Group would continue to work with stakeholders, and relevant agencies to strengthen, refine, and implement actions contained in its Bioenergy Action Plan related to use of forest biomass (page 85 of the Update)." For the purposes of the environmental analysis, this recommendation was deemed to encourage construction and operation of biomass facilities.

The commenter expresses concern that quantities described in the Bioenergy Action Plan (e.g., technically available biomass is estimated to be approximately 36 million bone dry tones per year…page 10 of the Bioenergy Action Plan) would result in a dramatic expansion of construction and operation of biomass facilities. This section of the Bioenergy Action Plan describes the potential feedstock in an effort to demonstrate the feasibility of using biomass energy from agriculture, forestry, and urban-derived materials. Regardless, the Update, in essence, recommends support for the Bioenergy Interagency Working Group continued progress associated with its proposed action and not the incorporation of all mentioned projects.

ARB's policies associated with biomass use is described in the Cap-and-Trade FED, which is incorporated by reference in accordance with California Code of Regulations, title 14, section 15150. The Cap-and-Trade FED fully analyzed the potential for adverse impacts resulting from the Forest Protocol. The Forest Offset Protocol would not allow any forest management activity that is not

allowed by state, federal, or local laws and regulations. In addition, the Forest Offset Protocol includes environmental safeguards to help assure the environmental integrity of forest projects. These include requirements for projects to demonstrate sustainable long-term harvesting practices, limits on the size and location of even-aged management practices, and requirements for natural forest management that require all projects to utilize management practices that promote and maintain native forests comprised of multiple ages and mixed native species at multiple landscape scales.

The commenter asserts that the Draft EA should include feasible mitigation measures that are within ARB's purview, "such as delaying efforts to expand biomass facilities as called for in the Bioenergy Action Plan until the state develops forest sustainability criteria and other environmental safeguards." While the Bioenergy Action Plan is not a regulatory document, because the Update recommends the continued work of the Bioenergy Interagency Working Group on these issues, language was added to the final version of the Update regarding the need for continued efforts to examine overall environmental issues associated with potential biomass facilities. The recommendations in the Natural Working Lands Sector and Agriculture sector now includes the following processes associated with the biomass recommendations:

- Strengthen, refine, and implement actions contained in its Bioenergy Action Plan related to use of forest biomass.
- Evaluate the potential biomass energy generation capacity.
- Develop methods to quantify biomass life-cycle GHG flux.

5-5 Comment 5-5 indicates that "[t]he EA states that unspecified types of renewable energy facilities may have potential criteria and hazardous air pollutant emissions, but then concludes that following project-level review and mitigation none of these sources would have emissions above applicable significance thresholds. Accordingly, the EA concludes that operational emissions will be less than significant." The letter references the Draft EA at pages 64 – 65. The letter then states and attempts to describe that there is no evidentiary basis for this claim.

The analysis on pages 64 – 65 of the Draft EA indicates that the operation of certain types of renewable energy projects such as solar PV farms and wind turbine farms could result in indirect emission reductions by displacing emissions associated with fossil-fuel power plant generation and could also have local air quality benefits. The analysis also indicates that the operation of combined heat and power (CHP) and/or carbon capture and sequestration systems or other technologies at an existing or new facility could adversely affect local air quality emissions depending on the technology type used; and includes a table of the primary pollutants associated with CHP technologies.

The analysis indicates that the authority to permit and operate these kinds of projects would be subject to local air district stationary source rules and would be required to comply with applicable air district rules and regulations, including best available control technologies and measures. As described in Section 15126.4(a)(2), "[m]itigation measures must be fully enforceable through permit conditions…," which would be required by local air district rules and regulations to allow for implementation of relevant projects. Thus, the Draft EA concludes that the air emissions from any facility that may receive a local air quality permit would be considered less than significant because it would not be allowed to have emissions that exceed local air district requirements. Since certain air districts, such as the SJVAPCD, exceed ambient air quality standards, the potential for developing additional biomass generating facilities in these districts is highly constrained.

5-6 The commenter states that "[t]he EA completely fails to disclose or analyze any potential air quality impacts of increased municipal solid waste (MSW) conversion, transformation, and incineration, even though expanded waste to energy projects are explicit goals of the Update (at 75), Bioenergy Action Plan (at 21) and the Waste Management Working Papers." Expanded waste to energy projects are not goals of the Update at page 75 or elsewhere.

While page 21 of the CEC's 2012 Bioenergy Action Plan, includes a policy or goal to increase energy production from urban derived biomass (including MSW), this policy is not incorporated in the Update. This policy or goal of the Bioenergy Action Plan is also contingent on legislative changes, which are beyond the control of any State agency. In addition, as previously noted, not all of the working paper recommendations were incorporated into the Update.

5-7 Comment 5-7 states that "[t]he EA acknowledges that construction and operation of new biomass facilities could have significant air quality impacts (at 75 – 77). The analysis, however, lacks detail essential to public and decision-maker understanding of the scale and severity of these impacts. The document's legal mitigation measures and significance conclusions also lack legal and factual support."

This section of the Draft EA acknowledges that "key recommendations" within the Natural and Working Lands section of the Update (as well as the Energy sector) could encourage the use of biomass to produce electricity and transportation fuels. The Draft EA also notes that while it is not possible to determine the long-term operational emission impact (without specific development project details), long-term air quality impacts associated with the Natural and Working Lands sector could be potentially significant.

Therefore, not only does the analysis clearly state that the long-term air quality impacts of biomass facilities could be potentially significant, but as previously noted, the analysis on pages 64 – 65 provides sufficient detail of the potential

types of pollutants as well as the individualized emission control and permitting standards that would be required to operate in specific air districts or basins.

5-8 The commenter correctly notes the Draft EA indicates carbon capture and sequestration (CCS) facilities in California could potentially be used for enhanced oil recovery (EOR), in addition to the purpose of permanently sequestering carbon—see page 15 of the EA. This comment letter indicates that "the EA omits discussion of the potentially significant GHG emissions that could result from the combustion of the oil developed from EOR operations."

However, unlike the development of CCS facilities designed to sequester CO_2 as a potential response to the energy (and other) policies of the Update, the Draft EA does not assume or indicate that these policies would encourage or lead to the use of CCS for EOR; it simply provides an informational sentence that "In some cases enhanced oil recovery has been proposed in conjunction with CCS projects in existing oil fields." However, using EOR as a technique to recovery oil would not increase the market demand for fossil fuels. Thus, consumption rates of oil in the State would not be expected to increase and there would be no increase related to GHG emissions from fossil fuel sources.

Page 126 of the EA states, " [b]y increasing the share of total electricity generated from wind, solar, and other renewable sources, fuel combustion could be substantially decreased." Any plan involving the use of bioenergy, associated with the Update and compliance with AB 32 would require that GHG emissions are reduced.

The Update states that "ARB will propose enhancements to strengthen the LCFS. ARB will also consider extending the LCFS beyond 2020 with more aggressive long-term targets, such as a 15 to 20 percent reduction in average carbon intensity, below 2010 levels, by 2030 (Page 16 of the EA)." As described above, the LCFS is a performance-based regulation that does not prescribe specific fuels for compliance; and therefore does not promote the development of any particular fuel.

As stated above, a Draft EA for amendments to the LCFS, which will evaluate GHG emissions, and is anticipated to be release later this year.

5-9 The commenter asserts the EA inadequately considered the effects of increased biofuels usage in the transportation sector. The Project Description of the Update in the EA describes the proposed enhancements to strengthen LCFS. Previous environmental analyses prepared for the Scoping Plan in 2008 and 2011 have been incorporated by reference in the Draft EA. These documents provide a discussion of anticipated GHG emissions associated with LCFS. However, as described on pages 9-10 of Attachment 3 to the Draft EA, the LCFS is currently under revisions in response to court-ordered corrective actions.

Release of regulatory amendments will be accompanied by EA later this year, and will disclose any anticipated effects on GHG emissions.

No specific details associated with LCFS amendments were available at the time of release of the Update. The commenter expresses concern that the EA – without identifying a mitigation solution – recognizes that some biofuels are associated with higher GHG emissions. While that abstract statement, taken out of context might be correct, the entire purpose of the LCFS and indeed other LCFS programs in other jurisdictions is to *reduce* the GHG emissions associated with transportation fuels. The commenter focuses on the statement that some fuels have high life-cycle GHG emissions, while ignoring that the existing LCFS discourages such fuels and indeed requires overall reductions in GHG emissions. Amendments to LCFS are included in part of the Update project description as an acknowledgment of on-going program planning. Because no physical changes to the environment are proposed with this recommendation, there are no environmental impacts to mitigate at this time.

5-10 The commenter expresses concern about the use of the term “carbon neutrality” in the EA with respect to GHG emissions associated with biomass feedstock. For example, the commenter states: “the natural carbon cycle theory of carbon neutrality is entirely unsupported and demonstrably incorrect.”

ARB recognizes there is disagreement on the issue of “carbon neutrality” related to biomass feedstock. The Draft EA used the term to generally reference how biomass feedstock is treated under the State’s existing Renewable Portfolio Standard and other programs; ARB is not proposing to treat biomass as a carbon neutral material. ARB’s existing Cap-and-Trade Program for example, exempts biomass facilities from compliance obligations based on the biogenic origin of the source fuel rather than on the basis of the potential “carbon neutrality” of the fuel. No change to this exemption provision is included in the Update. To address this concern raised by the commenter, staff has clarified in the final version of the Update (in the Natural Working Lands and Agriculture Sectors) that part of the cross-sector coordination needed for developing recommendations for both small-scale and utility-scale biomass energy facilities should include addressing the potential environmental impacts of biomass, including the life-cycle GHG flux (see response 5-4 above).

5-11 With regard to the issue of biomass as “carbon neutral” see response to comments 5-4 and 5-10.

5-12 The commenter asserts that the EA should have examined an alternative that delays implementation of expansion of bioenergy pending further study of the GHG, criteria pollutant, forest, and habitat impacts asserted elsewhere in the comment letter. The alternatives analysis in the EA provided several approaches to complying with the overall objectives of the Update while addressing the overall impacts associated with potential implementation of the recommended

actions in each of the sectors in the Update. (See Response to Comment Letter 3 for more information.) The suggestion for an alternative that removes one recommendation addresses only one component of the overall Update. Additionally, it does not meet the requirement to provide a comprehensive alternative to the Update that can meet the overall project objectives while addressing the overall impacts associated with Update.

Further, the alternatives analysis reflects that the project is a broad plan with broad recommendations to further aligning the State's longer-term GHG reduction goals with other State policy priorities. Specific regulatory actions that ARB or other agencies decide to pursue to implement specific recommendations will require additional action by the lead agency with jurisdiction over that action. The examination of the potential for adverse impacts associated with particular actions could be examined when those actions have been defined with more specificity and any mitigation could be incorporated as part of the lead agencies approval of a particular action. As stated above, language was added to the final version of the Update regarding the need for continued efforts to examine overall environmental issues associated with potential biomass facilities as part of the recommendations in the Natural Working Lands and Agriculture Sectors.

ENERGY SOLUTIONS

Letter 6

November 1, 2013

Mike Tollstrup
Chief, Project Assessment Branch
1001 I Street
California Air Resources Board
Sacramento, California 95814

Subject: AB32 Scoping Plan Update – Passenger Vehicle In-Use Efficiency and Fuel Efficient Tires

Dear Mr. Tollstrup:

Thank you for the opportunity to provide comments on the discussion draft AB32 Scoping Plan update. We encourage you to build on California's leadership reducing transportation emissions by including passenger vehicle in-use efficiency in the update.

In particular, we recommend that the update include a pathway for deployment of fuel efficient passenger vehicle replacement tire and engine oil technology. We recommend including fuel efficient tire incentives for a limited time period, ratings, and then standards to permanently shift the market. These programs would allow drivers of every income level to participate directly in the benefits of AB32 with fuel savings of 4% when installing replacement tires. We estimate that fuel efficient replacement tires would achieve greenhouse gas (GHG) reductions of three to four million metric tons carbon dioxide equivalent ($MMTCO_2e$) per year (tailpipe and upstream GHG baseline emissions from vehicles with replacement tires are about 100 $MMTCO_2e$ per year). We also encourage evaluation of potential measures for improved engine oil technology for the in-use fleet. 6-1

We have attached suggested language for the scoping plan update and appreciate your consideration of our comments. Please contact me or have your staff contact me at epike@energy-solution.com or (510) 482-4420 x239 if you have any questions.

Sincerely,

Ed Pike

Ed Pike, P.E.
Senior Project Manager

1610 Harrison Street, Oakland, California 94612 Phone:510.482.4420 Fax:510.482.4421

Comment Letter 6 Response

6-1 In response to Comment 6-1, Attachment 3 of the Draft EA has been edited to include the following underlined text:

> "(T-4) Vehicle Efficiency Measures (tire inflation, use of low friction oils, cools paints <u>and fuel efficient passenger vehicle replacement tires</u>)."

Letter 7

Western States Petroleum Association
Credible Solutions • Responsive Service • Since 1907

Catherine H. Reheis-Boyd
President

November 1, 2013

Via web and email: **http://www.arb.ca.gov/cc/scopingplan/2013comments.htm**

Ms. Edie Chang
Deputy Executive Officer
Air Resources Board
1001 I Street,
Sacramento, CA 95814

RE: Comments on First Update to AB 32 Scoping Plan (Update) – October 15, 2013 Workshop

Dear Ms. Chang:

The Western States Petroleum Association (WSPA) is a trade association representing 27 companies that explore for, develop, refine, market and transport petroleum, petroleum products and natural gas in the Western States. WSPA appreciates the opportunity to provide input on the Update to the AB 32 Scoping Plan (Update).

We believe it is important that the Update be prepared in a manner consistent with AB 32's requirement for the California Air Resources Board (ARB) to update the 2008 Scoping Plan at least once every five years to achieve the maximum technologically feasible and cost-effective reductions of greenhouse gas emissions. As we previously suggested in our comment letter in August (attached), a key task of the Update should be to review the 2008 Scoping Plan to ensure that measures to achieve the 2020 emission reduction mandate are technologically feasible and cost effective. *We reiterate our earlier comments that the ARB authority under AB 32 extends only to the 2020 mandate*. No goals, objectives, or plans for GHG reductions beyond 2020 have been authorized by the legislature. 7-1

Again, as mandated by AB32, the Update must focus on implementation, progress and plans for AB32 policies and regulations. While aspirational goals of recent Executive Orders are of interest, they do not belong within the scope of this Update and should not be included in it. If ARB wants to make

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recommendations to the legislature based on Executive Orders, they should be developed in a separate document.

A second issue is the need for ARB to take into consideration the cost-effectiveness and efficacy of current and proposed regulatory programs under AB32. The Update and any future documents in response to legislative action must address the costs, feasibility, cost-effectiveness, sources of funding, timelines and milestones of the proposed policies and measures.

WSPA sees this Update as critical to the implementation of AB 32 for the following reasons:

i) It provides an opportunity to incorporate new scientific, economic and technical studies that have been commissioned by stakeholders and ARB, alike, since passage of AB 32 in 2006;
ii) It provides ARB an opportunity to modify aspects of the Scoping Plan as a result of experience gained in the State, in the U.S. and elsewhere;
iii) It allows ARB to reveal any regulatory actions that might be needed for implementation of the 2008 Scoping Plan in relation to the authority vested in the ARB by AB 32; and
iv) It provides an opportunity for ARB and interested stakeholders to identify elements that need to be postponed or need further study prior to implementation.

Clarify the Scope of Update

This Update should not be used as an opportunity to expand GHG emission reduction planning efforts beyond 2020, nor to establish a new emissions reduction goal in 2050. We recognize the Agency's interest in pursuing the objectives established in the Executive Orders issued by Governor Brown and Governor Schwarzenegger. However the ARB should not conflate the legislative and regulatory requirements of AB 32 and the required Update with the aspirations in Executive Orders for GHG reductions beyond what is defined under AB 32. 7-1 cont'd

Recommendation: This Update to the Scoping Plan must concentrate its plans and programs on the statutory requirements of AB 32.

We reiterate our earlier recommendation that ARB limit the scope of the Update to achieving the 2020 goal in a technically feasible and cost-effective manner that minimizes economic impacts, emissions leakage and job losses.

Limit Update to 2020 Goals: Need for Legislative Approval for Goals Beyond 2020

The presentation at the October 15, 2013 Workshop indicated that ARB and other state agencies are moving ahead with the development of the 2030 and 2050 emission reduction goals without statutory authority. We urge the ARB to exercise caution rather than embarking on an extreme mission without the necessary authority, without a strong technical basis and without consideration of the economic consequences of these actions on California's citizens and business community. For example, ARB has cited documents (see listing on Page 75 of the Scoping Plan) that outline a vision of future environmental programs. Because there is great uncertainty as to the cost, cost-effectiveness, and

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feasibility of these programs, ARB must make a concerted effort to document the economic and technical feasibility of these plans.

As we noted in our earlier comments on the Scoping Plan, the Update is overly broad and reflects "aspirations for emission reductions" post-2020 – aspirations that need to be evaluated separately from this Update. Again, presenting such information in this Update concerns us for the following reasons:

- It implies a mandate which may lead to future disputes regarding ARB's authority to impose the mandate through new regulations. The Environmental Assessment being prepared for this Update could exacerbate such disputes.

- WSPA is concerned that an Update characterized by largely undefined goals, ideas and strategies may be erroneously construed as enforceable. In other words, perceived mandates from the Updated Scoping Plan may impact local land use or air district permitting. For example, Slide 12 of the October 15, 2013 presentation shows that an Environmental (CEQA) Assessment will be prepared covering "foreseeable methods of compliance" and "feasible mitigation measures." This type of CEQA assessment is triggered when agencies are contemplating a regulatory decision, and have led to permitting issues for facilities (i.e., the SANDAG lawsuit on the implementation of the 2050 Regional Transportation Plan). The preparation of the Environmental Assessment document, while perhaps a useful tool is premature and leads to concern that ARB or others could erroneously consider the Update as having regulatory effect, when in fact, it does not. 7-1 cont'd

- The Recommendations to Transition Beyond 2020 essentially document the ARB and Administration's aspiration to de-carbonize the California economy. Inclusion of such recommendations regarding an aspirational goal is not appropriate for the Update. Plans to "de-carbonize" energy generation, for example, are speculative, premature and should not be adopted, at least at this time in this context. In addition, ARB lists several measures for immediate implementation in the update without providing analyses that explain the basis for the selection of these measures. Measures that presuppose the best future technology risk not only failing on their merits but also discourage future technologies that could be successful.

  If the Agency were to contemplate goals beyond 2020 in another forum, there are many necessary considerations that must be addressed in the proper forums, including:

  - What are the consequences to Californians of going forward virtually alone to implement extreme goals without linkage to jurisdictions larger or at least similar in size to CA. Without linkage to larger markets, the cap and trade program and covered entities could face substantial allowance and offset shortages. This hardship would be felt in spite of the lack of any meaningful global impact by California's GHG reductions. [1] Are the proposed post 2020 elements technically feasible and cost-effective?

[1] We recognize linkage of the California program to Quebec. However, Quebec's carbon market adds less than 20% of additional allowances into the merged cap and trade markets.

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- Is the timeline to meet 2030 and 2050 goals realistic? Are the proposals designed to transform California's transportation system to exclusively electric and fuels cells realistic? Is the technology available for implementation? Will California become an electricity island?
- What is the impact on the existing transportation system? Are conventional vehicles, fuels (both conventional and low carbon) and the infrastructure to deliver these fuels adequate, reliable and affordable?
- What is the overall impact on the California economy and jobs and how does California transition so as to minimize impacts (as required by AB 32)?
- What is the overall cost of this transformation? Where will the funding come from? How will funding be allocated?
- What legislative authority is needed to implement individual plan elements and funding for those elements?

Recommendation: ARB should clearly define elements of the Update that are required to achieve the statutory requirements of AB 32 (i.e., achieve 1990 GHG emission levels by 2020) and limit the Update to those issues. This Update should clearly assess the effectiveness and costs of all the 2008 Scoping Plan Measures (achieving both the maximum technologically feasible and cost-effectiveness criteria in AB 32) and their impact on the Business as Usual (BAU) forecast, on the emissions inventory and the prospects to meet the 2020 mandate.

7-1 cont'd

ARB should separately, apart from this Update, identify all other plans, programs, policies and aspirations it sees as playing a role in achieving future emission reduction targets. Such policies, programs, and goals should also identify legislative, economic, regulatory and planning elements that would be important to achieving emission reduction milestones. ARB should clearly acknowledge that goals suggested in Executive Orders are only legally relevant after the legislature acts to incorporate those goals into law.

Citation of Ongoing Technical, Economic and Regulatory Reviews

The Update should incorporate a section that summarizes the ongoing efforts to implement AB 32. For example, ARB should specifically discuss the potential economic benefit of the proposed changes to the industry Assistance Factor (AF) and the implications of the 25% reduction in allowances in the third compliance period. ARB should discuss the risks of trade exposure to show how they will comply with the Board direction to minimize leakage.

ARB should also address the implications of California "going it alone", because linkage opportunities have not progressed as expected.

Recommendation: Include within the Update a review of studies that are completed, in-progress, and planned so that stakeholders understand the level and implications of research currently underway, such as for trade exposure, for achieving the 2020 goals. Such a presentation will help guide further AB32 efforts to minimize trade exposure and prevent unintended emissions leakage.

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Need for Review of Impacts and Feasibility of the Low Carbon Fuel Standard (LCFS)

This Update is a chance to review the implications, and impacts and feasibility of the LCFS. Specifically, given new data, ARB should take this Update as a chance to review whether it is still appropriate to include transportation fuels coming under the cap and trade program and the ramping up of the LCFS. We note particular areas where ARB should provide additional information.

- On page ES-2, the document asserts that LCFS has "helped displace 2 billion gallons of gasoline and diesel". This assertion is very misleading as most of these gallons were displaced by initiatives or drivers other than the LCFS. For example, in 2012, CEC estimated that nearly 1.5 billion gallons were displaced largely by the 10% ethanol blending requirement that pre-dates effects of implementing the LCFS (2013 draft IEPR). While there was some small amount of E85 growth in recent years that could be attributed to the LCFS, it seems clear that most of this ethanol was pre-existing.

  Similarly, WSPA assumes that CARB has included estimates of petroleum displaced by natural gas vehicles. Again, most of this fuel use pre-dates implementation of the LCFS. Moreover, the LCFS has had little to no impact in increasing the use of natural gas as evidenced by the relative constant rate of natural gas-related LCFS credit generation since the program started in 2011. With respect to the growth of electric vehicles (EV and the like), it is realistic to argue that the observed increase in EVs stems more from direct subsidies and has little to do with the LCFS. 7-1 cont'd

  Recommendation: WSPA suggests that CARB revise this displacement volume to reflect only what is creditable to the LCFS.

- On pages 22 and 53, CARB asserts that 23 MMT (Million Metric Tones) of reduction in the transportation sector are attributed to the fuel and vehicle initiatives. WSPA would like to better understand the basis for this data, including precise breakdowns of how and where (both geographically and within the fuel lifecycle) the emission reductions have occurred. WSPA would like CARB to specifically delineate reductions separately based on geography and fuels vs. vehicles. The basis of these data is not clear. ARB should clearly identify the origin of the data so that all stakeholders have an opportunity to review it and compare it to other sources of information.

  Another concern is related to potential double-counting of the emission reductions from the vehicle fuel efficiency standards and the LCFS. One cannot, in all cases, base additional LCFS-related reductions on increased biofuel use with the shrinking fuel demand that is projected from the vehicle fuel efficiency increases. Any estimate of projected reductions requires careful calculation and public review.

  It would be valuable to understand the calculations behind this reduction number; as well as the actual reduction to date along with the supporting calculations.

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Recommendation: ARB should reveal the basis of all projected emission reductions and trends cited in the Scoping Plan and Update. Moreover, the ARB calculations should reflect the actual progress to date and then build on that number for future projections. Finally, these calculations should be made available to the public for review as there are potential issues with how this calculation was made. WSPA would like CARB to specifically delineate reductions separately based on geography and fuels vs. vehicles. 7-1 cont'd

It is our intent to provide more detailed comments on these and other issues as ARB moves forward with development of this Update. Thank you for the opportunity to comment and we look forward to discussing this with you in the future. Should you have any questions, feel free to contact me or Mike Wang of our staff (cell: 626-590-4905: email: mike@wspa.org).

Regards,

Attachment: August 5 comment letter on Scoping Plan

Cc: Richard Corey (rcorey@arb.ca.gov)

WSPA Update to AB 32 Scoping Plan.pdf

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Comment Letter 7 Response

7-1 The comment raises a variety of issues, including, e.g., the extent of ARB's regulatory authority as it relates to the content of the Update. As a threshold matter, ARB observes that its regulatory authority is set by statute. In any event, pursuant to ARB's certified regulatory program, ARB responds solely to those portions of the comment that relate to the adequacy of the ARB's environmental analysis or raise significant environmental issues associated with the Update. (See comment letter at p. 3, first two bulleted paragraphs.)

The comment appears to question why ARB prepared an environmental analysis for the Update. As stated in the EA's Project Description, Section 2.0, ARB considers the recommended actions for each of the nine sectors discussed in the Update as a "project" under CEQA. Because it is reasonably foreseeable that regulatory actions may be initiated to carry out the recommended actions in the Update, and that those subsequent regulatory actions could result in indirect physical changes in the environment, ARB determined that an EA should be prepared in accordance with ARB's certified regulatory program (Cal. Code Regs., tit. 17, §§ 60000 – 60008) to comply with the requirements of CEQA.